DOCUMENT RESUME

ED 368 699 SP 035 126

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TITLE Preservice Teachers' Development of Pedagogical Understandings and Epistemological Frameworks.
PUB DATE Apr 92
NOTE 52p.; Paper presented at the Annual Meeting of the Educational Research Association (San Francisco, CA, April 20-24, 1992).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Cognitive Development; Conceptual Tempo; Educational Psychology; Elementary Secondary Education; *Epistemology; Higher Education; Individual Development; *Instruction; *Knowledge Level; Metacognition; *Preservice Teacher Education
IDENTIFIERS Preservice Teachers; Reflective Thinking

ABSTRACT

This study assessed 72 undergraduate preservice teachers' development of broad pedagogical understandings in relation to an informal reasoning framework and instructional processes. Subjects completed a set of 11 open-ended planning tasks, self/course evaluations, and a measure of learning orientation for a course in educational psychology. The tasks facilitated the application of both broad and specific pedagogical concepts, previous knowledge and beliefs about classrooms, subject matter knowledge, and knowledge about classroom planning. A general theoretical framework which delineates a model of informal reasoning, assessment of levels of understandings based on quality, and instructional processes which encourage the development of preservice teachers' pedagogical understandings is presented. The framework is viewed in light of the more global considerations of teacher socialization processes and teachers' personal growth. Results indicated that those individuals who do not adopt a reflective stance on learning may have difficulty in furthering their conceptions and understandings of how their students will learn and develop. A form of empowerment came from subjects examining and understanding their own epistemological frameworks and ideas about pedagogy. Appendixes provide additional information on the tasks and pedagogical levels of understanding. (Contains 32 references.) (JDD)

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Preservice Teachers' Development of Pedagogical Understandings and Epistemological Frameworks

by

Chris L. Lawrence

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Paper presented at the Annual Meeting of the Educational Research Association, April, 1992, San Francisco.

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Preservice Teachers' Development of Pedagogical Understandings and Epistemological Frameworks

Chris L. Lawrence

Abstract

This study presents one method for assessing preservice teachers' development of broad pedagogical understandings in relation to an informal reasoning framework and instructional processes. The participants in this study were 72 undergraduate preservice teachers who completed a set of 11 open-ended planning tasks, self/course evaluations, and a measure of learning orientation for a course in educational psychology. The tasks facilitated the application of both broad and specific pedagogical concepts, previous knowledge and beliefs about classrooms, subject matter knowledge, and knowledge about classroom planning. The way participants conceived, developed, and structured the tasks is described in two sets of holistic scoring rationales, representing across tasks and within tasks analyses. High interrater reliability (r = .89 - .91) and internal consistency (α = .85) was obtained when applying the Levels of Pedagogical Understanding (task specific rationales) to participants' responses. An analysis of individual profiles resulted in an initial formulation of a typology for epistemological frameworks.

This study, in its broadest sense, describes how preservice teachers in an educational psychology class make meaning of pedagogy. Goodlad (1990) thinks there is an overwhelming dominance of classroom teaching for low-level intellectual skills (he sees that even the basics are not being successfully taught in classrooms) and that the problem can be traced back to teacher preparation programs. Studies have indicated that teachers are not adequately prepared to engage in complex reasoning and elicit higher-level thinking and discourse in classrooms. More complex understandings of cognitive, social, and moral aspects of children's growth or how to adequately facilitate and plan for children's growth are often not explored and not taken up as a primary purpose in research. This may be a result of little emphasis in studies on how teachers develop understandings of pedagogy and about how teacher preparation programs can encourage development through instruction. The domain of educational psychology has become enormous, the research prolific, and the purposes varied. Students often see educational psychology, and many other required education courses, as hoops they had to jump through in order to graduate, become certified, and start teaching. A large part of the problem is that students do not feel they are learning anything useful or relevant to actual teaching practice or not experiencing forms of personal growth. Students see their coursework as relevant when the instructional content and process are meaningfully connected to their development as teachers. One of the most difficult tasks for teacher educators is to help individuals broaden their perspectives and develop deeper pedagogical understandings. How does one teach courses like educational psychology with complex and diverse content and focus on higher-order thinking? To answer this question the following questions must also be addressed. How does the instructional process interact with students' ability to make deeper meanings of content?, How can different levels of understanding be taken into account to promote development?, and What theoretical frameworks would support these concerns?

I have found that each of my students has some epistemological and pedagogical understandings which guide them whether they are simple or complex, limited or broad, disparate or integrated, and many manifestations in between. In responding to open-ended tasks developed for this study, some individuals give typical behavioral solutions even when directed toward cognitive solutions, often indicating they would direct their own students' conceptions by focusing on right/wrong answers or acceptable/unacceptable classroom behaviors. Other individuals develop plans indicating a dynamic and fairly well-developed conception of thinking and of instruction's role in promoting and diagnosing students' development. As with Ahlquist and O'Loughlin (1990), this study reveals that some individuals have an overly authoritarian stance toward teacher's and students' classroom roles. When asked to plan for preventing discipline problems, these individuals give answers that reflect a tight control on what can occur in the classroom even to the point of limiting the learning and social interactions which could take place. These individuals often give answers representing reactive approaches to discipline, what they will do after a discipline problem occurs and provide no proactive approaches. Other individuals promote proactive measures such as engaging students in meaningful learning, being sensitive to students' emotional needs, focusing on more natural consequences, and structuring the classroom so tools for learning are available to help lessen discipline problems and spend more classroom time on meaningful activities. They will often describe an entire system, first setting up a positive environment, getting their students involved in making decisions about rules and consequences for the unacceptable classroom behaviors, and elaborating upon their own role in the classroom. Of course, many individuals portray different mixtures of conceptual understandings and fall somewhere between the extremes described here. A goal of this study was to more clearly delineate a continuum of pedagogical understandings and epistemological frameworks of the preservice teachers who participated.

This study will present a means of assessing preservice teachers' development of pedagogical understandings and epistemological frameworks through semi-structured, ongoing, and authentic tasks within the time frame of one course (in the context of educational psychology). The tasks provide for individual variation in the construction of meaning, accounting for not only individual variations in style but also in age and subject matter concerns. The method of assessment focuses on generalizable themes and developmental continuums related to broad pedagogical understandings. A general theoretical framework which delineates a model of informal reasoning, assessment of levels of understandings based on quality, and instructional processes which encourage the development of preservice teachers' pedagogical understandings will be presented. The framework is viewed in light of the more global considerations of teacher socialization processes and teachers' personal growth. An individual's personal growth and learning approach are viewed as integral to their development of pedagogical understandings.

A Framework for Informal Reasoning and Assessing Levels of Pedagogical Understandings

Pintrich (1990) reviewed the literature on psychological research and discussed the implications of this research for teacher education. He identified these four specific areas of concern as important to future research on teacher education: teachers' (a) knowledge, (b) thinking and problem solving, (c) metacognition and self-regulation, and (d) motivation. Each of these concerns however, could be defined in many different ways, i.e., there are many definitions of thinking and problem-solving currently in use. In the following discussions, the concerns addressed are preservice teachers' (a) pedagogical understandings, (b) informal reasoning, (c) reflectivity, and (d) learning approach. The paradigm for teacher learning is constructivist, based on conceptions of how reasoning develops and how individuals make meaning of pedagogy.

A key factor in many studies on teaching cognition lies in their emphases on how cognition develops or what knowledge develops. A number of researchers have delineated the importance of teachers' conceptual structures, understandings, and systems and the limitations which occur when these are too simplistic or under-developed or how they are facilitated when complex and well-developed. The quality of teachers' conceptual systems can help them account for the inherent complexities in classrooms, plan for flexible activity, and find deeper meaning when interpreting classroom events (Calderhead, 1981). Livingston and Borko (1989) propose that successful improvisational teaching is facilitated through an extensive network of interconnected and accessible schemata. They find that the quality of a teachers' knowledge is a major influence in improvisational teaching. The schema or cognitive structures, related to knowledge of teaching, are important to consider when planning instruction for preservice teachers to help individuals assimilate, retain, and process information related to teaching (Livingston & Borko, 1989; Peterson & Comeaux, 1987). Knowledge and knowledge structures will affect the way a teacher will account for the complexities of the classroom and interact with their reasoning about complex events. Most studies on teacher cognition also advocate instruction in teacher education based on an individuals' level of development (Livingston and Borko, 1989; Peterson & Comeaux, 1987; Berliner, 1989).

Previous studies have attempted to define what knowledge is import by studying experts/experienced teachers, but these are lacking in pedagogical content structures, developmental continuums, and instructional theories which can be directly applied to preservice education. Missing from current studies on teacher cognition (with a few exceptions, e.g., Ammon & Hutcheson, 1989) is a description of what knowledge is important to know and how knowledge structures are organized. To assess progression in teachers' development, the method must account for different levels of understanding or levels of competence, guided by conceptions of higher-order thinking (Frederiksen, 1984; Wiggins, 1989).

The method in this study, was to develop a content structure based on broad pedagogical themes which are persistent in (or emerged from) the participants' responses, themes such as teacher's and students' roles in the classroom and the content and conceptual structure of classroom plans. Within each theme are levels of organization of knowledge or how this knowledge is structured. Pines (1985) explains the term cognitive structure, which is concomitant with how pedagogical knowledge is structured, in the following.

> What is the meaning of cognitive structure? The words give us important clues. Cognitive means "of the mind, having the power to know, recognize, and conceive, concerning personally acquired knowledge, " so cognitive structure concerns individual's ideas, meanings, concepts, cognitions, and so on. Structure refers to the form, the arrangement of elements or parts of anything, the manner or organization; the emphasis here is not on the elements, although they are important to a structure, but on the way those elements are bound together ... What binds them together are "relations". So too does their structure. The meaning that an individual gives to a particular word, and the complex conceptual framework that an individual possesses which makes him or her knowledgeable in a particular area both depend significantly on relations. (p. 101)

Pedagogical understandings become more complex in both form and function (relations) as development occurs. Pedagogical reasoning is facilitated through reference to broad pedagogical understandings and their interrelationships. Well-developed pedagogical understandings and epistemological frameworks, would not only aid in preservice teachers' interpretation of information on and development of knowledge about teaching and learning but could also help guide their actual classroom practice.

Peterson & Comeaux (1987) have drawn upon information processing and expertise literature in conceptualizing the function of schemas and general or fundamental principles as organizing agents within a domain of knowledge. In previous work on levels of cognitive complexity (McDaniel & Lawrence, 1990), we found that individuals who find deeper meanings in an issue or situation, organize their ideas around major themes and broad conceptions (in this study, pedagogical themes and context specific conceptions). These individuals are able to see the complexity in a situation and organize the many facets in a manner which simultaneously maintains the complexity and also simplifies the reasoning process by formulating priorities around what is valued, ethical considerations, and/or the most subsuming ideas/concepts. The organization or structure of the discourse facilitates (or limits) the integration of ideas with previous knowledge, new information, and larger bodies of knowledge (world knowledge, knowledge of systems).

McDaniel and Lawrence's (1990) rationale describes five levels of complexity which were apparent in individual's responses to open-ended and complex situations. As the complexity of thinking increases, the causal connections also increase as does the quality of the relationships formed. Validity for these structural properties is supported through a discourse analysis conducted by Lawrence and Stewart (1990). The scoring rationale is presented next.

Levels of Cognitive Complexity.

Level 1: Unilateral Descriptions
Simplifies the situation. Focuses on one idea or argument. Does not identify alternatives. Brings in no new information, meaning, or perspectives. Makes "good-bad" and "either-or" assertions. Appeals to authority or simple rules. Information is simply paraphrased, restated or repeated.

Level 2: Simplistic Alternatives
Identifies simple and obvious conflicts, but the conflicts are not pursued or analyzed. Develops a position by dismissing or ignoring one alternative and supporting the other with assertions and simple explanations rather than through deeper assessment of the situation.

Level 3: Emergent Complexity
Identifies more than one possible explanation or perspective. Complexity is established and preserved. New elements are introduced. Supports position through comparisons and simple causal statements.

Level 4: Broad Interpretations
Uses broad ideas to help define and interpret the situation. Manipulates ideas within the perspective established. Has a clearly recognizable explanatory theme. Ideas are integrated into "sub-assemblies" each supporting a component of the explanation.

Level 5: Integrated Analysis
Restructures or reconceptualizes the situation and approaches the problem from a new point of view. Constructs a network of cause-and-effect relationships. Ideas are integrated and extrapolated. Arrives at new interpretations by analogy, application of principles, generalizations, and world knowledge. Constructs organizing framework, sketches connections, and predicts consequences (McDaniel & Lawrence, 1990, p. 78).

This view is consistent with an informal reasoning framework. The theoretical background McDaniel and Lawrence (1990) discuss integrates other influences on the development of higher-order thinking, such as Perry's model of intellectual and ethical development (Perry, 1970) and an individual's reflective attitude (Siegel, 1989). This background is relevent to conceptualizing preservice teachers' development of pedagogical understandings and epistemological frameworks within instruction. The following sections elaborate this background in terms of their relevance for teacher education and promoting growth in preservice teachers. These sections are Informal Reasoning Frameworks, Adult Developmental Continuums: Building Personal Frameworks for Evaluating Knowledge, Teacher Reflectivity and Individual Learning Processes, Broad Considerations for Instructional Processes, and Developing Open-Ended Tasks.

Informal Reasoning Frameworks

Informal reasoning problems or situations have the following characteristics (from Galotti, 1989):

- Some premises are implicit, and some are not supplied at all.
- Problems are not self-contained.
- There are typically several possible answers that vary in quality.
- There rarely exist established procedures for solving the problem.
- It is often unclear whether the current best solution is good enough.
- The content of the problem typically has potential personal relevance.
- Problems are often solved as a means of achieving other goals (p. 335)

As would be expected, a description of the structure of formal reasoning problems sounds much like the opposite end of the continuum: premises are given, problems are self-contained and bounded, there are correct answers to the problem, and there are established rules for solving the problem. The framework for reasoning which is advocated serves as the basis for how the construct of reasoning (critical thinking or higher-order thinking) is defined and measured. Formal reasoning has typically implied solving problems that are well-defined and have a correct answer whereas everyday/informal reasoning has implied solving problems that are ill-defined and have many possible responses.

Situations which teachers must face when employing reasoning or planning for instruction are more similar to informal reasoning situations than formal reasoning situations (where there are correct answers, rules for solving the problem(s), and problems are bounded). This is not to say that all problems are unbounded in teaching, but rather that some more strictly bounded problems occur within mostly unbounded classroom situations. While teachers work within different premises (and under certain set conditions or guidelines, such as mandates for curriculum, etc.), the day-to-day activity is primarily filled with many decisions and inputs, all of which have personal relevance to both the teacher and the students. Teachers make sets of decisions regarding students, events, or instructional activitites, etc. which do not often coincide with an established procedure because there are not set procedures for handling all mixtures of possible classroom variables and occurence. In addition, independent problems are not solved or plans are not made as an end point in learning or as a goal in themselves, but as part of larger educational goals and concerns. For instance, curriculum decisions are made on many different levels, more specific decisions are in some way connected to more global and long term concerns.

Assessment of informal reasoning is developed in accord with the definition of constructs, the implied structure of the problem to be solved, the nature of the task to be performed, and the resultant individual meanings which are constructed. The model for informal reasoning already described was utilized in conjunction with pedagogy and subject matter content to formulate tasks and assessments which can be integrated into instruction. Tasks provided some structure and guidance (similar to premises) but did not define ridgid problems to be solved. In other words, the tasks were not self-contained, but were open to individual responses varying in quality and could be connected to broader concerns such as an individual's instructional goals and subject matter content. Assessment can focus on the range of individual and group understandings elicited through the task. Further discussion of assessment of individual responses and task considerations will be presented in a subsequent sections. Immediately following is a discussion of adult developmental continuums in relation to epistemological frameworks and levels of understanding.

Adult Developmental Continuums: Building Personal Frameworks for Evaluating Knowledge

Perry's (1971) theory or scheme of intellectual and ethical development in adulthood, describes nine qualitatively different positions (similar to developmental stages) of individuals. In this constructivist model; the focus is on individuals building their own frameworks for evaluating knowledge and how they

integrate these epistemological frameworks with their own personal and moral identities. In lower levels of cognitive complexity and adult intellectual and ethical development, reasons or support are often missing from the blanket assertions an individual will make or the ideas they will promote. There is an appeal to authority and set/simplistic answers. In the higher levels of these two schemes, individuals base decisions or judgements on what is viewed as important or what is valued. Judgements and decisions are supported with explanations and evidence. In the same sense, lower levels of pedagogical understanding represent simplistic ideas about children's learning, about classroom activities, and about the classroom environment which are asserted and promoted, but which are not supported through rationales and which do not take many classroom or learner variables into consideration. There is also an appeal to set and simplistic answers for teaching, learning, and the set-up of the classroom environment. Higher levels of pedagogical understanding represent ideas which take the complexities of the classroom and of learners into account. Solutions are arrived at or judgements are made which take multiple considerations into account, are supported through rationales, and are elaborated upon in terms of instructional and developmental considerations. O'Loughlin (1990) sees a connection between a teacher's intellectual and ethical growth and how they will view their role and their students' roles in the classroom. Some of the tasks in this study intersect with these same concerns, some more heavily loaded on teacher and student roles than others. In general, lower levels of pedagogical understanding portray the teacher as authoritarian and the student role as passive whereas in higher levels the teachers' role is more facilitative and the students' role is active. These roles often contribute to a vision of the classroom environment and the types of instruction and social interactions which will take place.

Pintrich (1990) points out that "... models for teacher development will have to allow for individual, contextual, and developmental variation but not be so dispersive theoretically as to be useless for generalization or as guides to practice" (p. 850). Perry's model is not directly applicable within the time frame of a course because it describes gross developmental changes. It is more directly applicable over the time frame of an undergraduate teacher education program. McDaniel and Lawrence's (1990) model of cognitive complexity, while applicable within the time frame of a course is essentially content free and is only applicable in certain contexts. However, the way understandings and frameworks develop in these schemes, along with conceptions of quality and form, is useful in conceptualizing, encouraging, and assessing teacher development. An informal reasoning framework in combination with an emphasis on measuring levels of understanding (like cognitive complexity where the quality of understandings can be ascertained) can contribute to these qualities in delineating one model of teacher development. This type of model allows for individual variation in constructions and the evaluation of generalizable qualities. Similar rationales have been constructed for this study which assess Levels of Pedagogical Understanding.

There are similarities between Perry's conception about the building of epistemological frameworks and the way preservice teachers build epistemological frameworks based on pedagogy. For this study, I have used the following conception of epistemological frameworks. Epistemological frameworks are the

complex sum of one's pedagogical understandings, conceptions, or beliefs. In other words, epistemologies are not just the additive sum of understandings, but are a web of understandings which are inextricably connected in some fashion. For some, pedagogical understandings play a symbiotic and synergistic role in formulating dynamic epistemological frameworks. For others pedagogical understandings can be somewhat discrete from one another and can limit each other. The epistemological frameworks are therefore simplistic or are disparate. Beliefs, conceptions, and pedagogical understandings are typically not static but are portrayed or manifested differently within different contents and contexts. As one conception, belief, or set of understandings are explored in relation to others, implicit relationships and connections are revealed and conceptions are adjusted and changed as these become evident/explicit to the individual. However, some individuals may not have a learning orientation or motivations which compel them to explore relationships among understandings. Their understandings and epistemological frameworks may change slowly or appear static.

Assessment of epistemological frameworks is difficult because one cannot look at epistemologies through a single lens or see an individual's epistemological framework in total through one attempt. In this study, individual profiles, representing a range of constructions in different contexts, were used to develop a typology of epistemological frameworks. Participants' broad pedagogical understandings in relation to the typology and the development of epistemological frameworks are described in a later section of this paper. Reflectivity will be discussed next as a major contributing factor to developing deeper understandings of pedagogy.

Teacher Reflectivity and Individual Learning Processes

A reflective attitude is congruent with Schön's (1988) conceptions of teacher reflectivity. It is best defined as an individual's propensity to engage in reasoning and to seek deeper meanings (Siegel, 1989). In the broadest sense, reflectivity is promoted through encouraging the active construction of meaning. The process may occur through such means as metacognition and self-reflection, (or simply reflection upon one's ideas) while the result, we hope, is deeper understandings and the development of one's personal understandings and epistemologies. What one ultimately hopes is that reflectivity will become a lifelong habit and become integral to teaching and learning. While McDaniel and Lawrence (1990) describe a reflective attitude as a major component influencing cognitive complexity, they do not explain how reflectivity is developed nor how it can be encouraged by the instructional process. Basic to this study is seeing reflectivity as already present in individuals, in vastly varying degrees, and as either facilitated, mostly unaffected, or limited by instruction. A number instructional methods facilitate greater reflectivity, such as journals about developing conceptions of pedagogy (O'Loughlin, 1990) or discussing actual teaching experiences in the classroom. In this study, the focus is on individuals developing deeper understandings through constructing responses to authentic teaching and learning tasks. The degree of authenticity of tasks is adjusted according to the participants' level of development. Pertinent to developing

reflectivity, according to this definition and in the context of instruction in teacher education programs, is the development of deeper learning approaches.

Entwhistle and Newble (Entwhistle, 1988) have formulated a model which describes three major learning approaches: surface, strategic, and deep. In their model, an individual's learning approach is influenced by predominant motivations, processes, and outcomes. An individual with a *surface approach* is motivated by a concern for completion of the course and fear of failure. This individual focuses on learning isolated pieces of information through mostly rote learning techniques. The outcome is either little or no understanding or a superficial level of understanding (substantial knowledge of factual information and providing adequate descriptions). An individual with a *strategic approach* is motivated by achievement of high grades and competing with others. This individual focuses on being successful (getting high grades) by using whatever means necessary. The outcome is a variable level of understanding depending on what is required in a course or by the methods of assessment utilized. An individual with a *deep approach* is motivated by an interest in the subject matter and by vocational relevance (the intention is to reach personal understandings). There can be three outcomes: (a) a detailed knowledge of relevant facts (evidence) but little integration of evidence with broad principles, (b) ideas are related together based on relationships between ideas but are unsupported by evidence, and (c) evidence and facts are related to ideas (broad principles) and is used to develop arguments.

Several pertinent points may be made about this model in general. First, the model indicates that making classroom instruction interesting and relevant and encouraging learners to search for personal understandings may also encourage learners to adopt deeper approaches to learning. It is difficult to expect students to be reflective without adopting this view of learning. Secondly, individuals' fear of failure and course completion needs to be attended to in order to expect more meaningful learning. Learners need safe atmospheres where they feel personal construction are valued and the instructor is there for both cognitive and emotional support. Third, the course structure (and classroom environment) and method of assessment interact with the way individuals approach learning and can limit or facilitate avenues for personal constructions. In essence, the method of assessment tells the learner what the instructor sees as important and therefore may affect how the learner approaches subject matter. As students encounter ideas they make meaning of these ideas by developing deeper understandings. This occurs by structuring and restructuring their own meanings about pedagogy and this process interfaces with and is influenced by instruction. How instructional processes and assessment can provide for these needed supports will be considered next.

Broad Considerations for Instructional Processes

How can instruction, and instructors, help individuals to become teachers who can not only cope but excel in the complex environment of the classroom? A proactive approach in developing instructional experiences must be taken because the answer is certainly not to expect them to just assimilate an ever

growing body of information on teaching and learning, expect them to become experts in subject matter content, while at the same time overcoming years of a socialization process which may not have prepared them well, essentially expecting them to learn their practice through experience after being placed in a classroom. Livingston and Borko (1989) suggest that teacher preparation programs design activities explicitly to "help novices develop and elaborate knowledge structures for teaching and pedagogical reasoning skills" (p. 39). However, this prescription may be too narrow. Kagan (1990) states that cognitive views in general have failed to affect the nature of teacher preparation programs and teacher assessment. Cognitive approaches may have failed in part because broader considerations of the instructional process and of the learner have not been taken into account. One must account for more than cognitive aspects and include also the socialization process in which cognitive growth is embedded (Goodlad, 1990; Pintrich, 1990; Veenman, 1984). A reasonable solution is to treat the socialization process as one where teacher education encourages a cognitive apprenticeship and mentoring approach that aids and values the development of individual pedagogical constructions, epistemological frameworks, and personal growth and provides a community that supports and fosters individuals' commitment to and knowledge about teaching and learning. Planning for instruction which facilitates preservice teachers development of broad and solid conceptual frameworks about the purposes of education, which has a clear conception of a basis in pedagogy, which accounts for teaching and learning from a holistic and dynamic view, and which seeks to develop common discourse would interact and support this type of socialization process. Additionally, it is important that teachers learn how to assess the entire range of their own students' understandings and set-up an environment which maximizes multiple levels of development. To do so means that teachers must gain experience and knowledge of these activities by being engaged themselves in socialization processes, developing understandings of how these processes are facilitated through the course/classroom structures, instructional activity, and methods of assessment. A course/classroom structure should be viewed not only in terms of the subject matter organization and the activities but also as integral to the socialization process.

Within the groups of individuals I have taught, as well as in the participants in this study, there is evident and broad variation, both in what these preservice teachers already know about teaching/learning and in their learning approaches. It is important to start with what preservice teachers' already know and how they structure what they know in order to promote development. As is promoted in Entwhistle and Newble's (1989) model of learning approaches, a guiding conception in my instruction and in developing this study was to start with the preface that a learner's motivations and learning approach are connected to the course structure and the instructor's methods of assessment and evaluation. Recent calls for authentic and alternative assessments that are systemically valid advocate the need for higher-order thinking and assessment as integral to instruction (Frederiksen, 1984; Frederiksen & Collins, 1989; Gardner, 1989; Linn, 1989; Pintrich, 1990; Resnick & Resnick, 1989; Wiggins, 1989). Course structures which emphasize ongoing, authentic/alternative assessments, and open-ended tasks encourages learners to explore and

construct their own meanings. When these are integrated with the instructional and socialization processes mentioned (such as cognitive scaffolding and mentoring) then an environment for promoting deeper meanings of subject matter and concerns for personal growth has been optimized. The tasks presented to participants in this study promote authentic activity in relation to preservice teachers' levels of development.

1. The participants were engaged in continuous writing and planning over the semester.
2. The participants were able to apply their knowledge of the subject matter and level of understanding of the age group they will be teaching.
3. The participants were able to use and make explicit the knowledge and theories they already had about teaching and learning and integrate new knowledge and concepts.
4. The tasks ask that the participants integrate different ideas and concepts about teaching and learning.
5. The completed works could be adapted or elaborated upon for later use in the classroom
6. The nature of the tasks required individuals to put themselves in the role of a teacher when considering situations.

In addition, several instructional processes were employed in the course to help facilitate participants' understanding. The participants were allowed to redo assignments after feedback to adjust and refine their ideas. This is similar to what Shulman (1989) calls including coaching in the assessment of teaching portfolios. Allowing assignments to be refined after feedback is more representative of the real world of teaching where others may give advice, resources may be utilized, and in the sense that plans and ideas are never solidified and set, but are constantly changed, modified, and adapted. Similarly, examples or partial examples of task responses were often provided during instruction. Group discussions, which were both planned and impromptu during classtime, also provided clarification or elaboration on misunderstood aspects of the assignments. These processes not only provide for cognitive support, but lessen individuals fears that they have to understand completely the first time they attempt a task.

Developing Open-Ended Tasks

Bennett (1988) also emphasizes a focus on the nature and quality of classroom tasks. To develop open-ended assignments, several considerations guided the choice of tasks and instructional strategies. The first consideration centered around task structures. In other words, how much structure is given by the task description itself and how much structure is the student asked to impose themselves. In previous work on cognitive complexity (McDaniel & Lawrence, 1990), a colleague and I had asked high school students to respond in writing to complex stimuli (videotapes) about current and past social issues. The task description was simply for the students to tell us their thoughts and ideas about these situations and to explain their thoughts as fully as possible, there was no cueing as to what they should focus on or any

criteria to which they must adhere in responding. In most open-ended learning tasks, however, the structuring purposes of tasks are typically to guide and scaffold students, make materials intrinsically interesting and challenging, and develop assignments which are open to meaningful individual constructions and which elicit certain types of knowledge or understandings. Since instructional activity, broadly defined, is the primary means through which students learn, activity should serve as both impetus and scaffolding for individual growth. In general, however, task cues and prompts vary according to the type of information which desired and the intended purpose. Totally open-ended task prompts are useful in exploring individuals realm of understandings in a manner similar to open-ended, unstructured interviews.

Decisions must be made about what types of knowledge are important to elicit given the time constraints of a course, considerations for adequate assessment and feedback, and the demands placed on learners. The meaning individuals give to independent concepts is not rich in information about their pedagogical understandings although their understandings are easy to access and few cognitive demands are placed upon the learners. More global tasks, such as longer term projects and papers, provide more information about pedagogical understandings and their ability to reason through situations, but if too global are less useful in providing consistent feedback to learners unless they are monitored in stages of project development. They are also difficult to score holistically and difficulties may arise in promoting a developmental continuum. The tasks chosen for this study struck a balance in these many concerns. They were semi-structured and required students to plan for various learning considerations and instructional activities. They constitute fairly short tasks which could be completed in a page or so of writing (sometimes drawings and charts) but elicited a wide range of pedagogical understandings.

In developing a method of assessment for this study, it was important to first determine how the participants conceptualize teaching and learning, to ascertain the basic themes that permeate their pedagogical understandings, and to develop ideas about the quality and range of pedagogical understandings. The two sets of scoring rationales that were developed, Levels of Understanding of Pedagogical Themes (context general) and Levels of Pedagogical Understanding (context specific), take into account the variation of individual constructions while reflecting participants' general depth of pedagogical understanding and the way understandings are integrated. Since this is the first attempt at developing a means of assessment for pedagogical understanding, the use of these rationales in instruction is not fully explored. However, there is evidence that integrating these open-ended tasks and this method of assessment could further an individual's understanding of pedagogy and help individuals develop epistemological frameworks.

Method

Participants

The participants were 72 individuals, 15 males and 57 females, enrolled in two sections (section 1, n = 40; section 2, n = 32) of an undergraduate introductory educational psychology course at Purdue University. This was a required course for 97% of the participants. Of these individuals, the ages ranged from 19 to 36 years, the mean age being 20.3 years. All participants were in their fourth semester of college or beyond (75% were in the second semester of their sophomore year). The distribution of participants stated grade level emphases upon graduation were as follows: preschool/kindergarten (7%), elementary school (45%), junior/senior high school (41%), adult/unspecified (7%).

Overall Procedure

The course included an emphasis on open-ended assignments and accepting the author as both instructor and researcher in the course, both of which were explained the first week of class and discussed with the students. The participants were neither recruited nor forced into participating, but were asked to participate as a part of this study. Although the course was a requirement for most participants, the participants could choose, within their scheduling limitations, among seven sections of the course. The other five sections of the course emphasized closed-ended tasks and assessment methods as the major basis for grades (students were aware of the course differences), although some open-ended tasks and assessment methods were also employed. A few students joined the sections involved in this study, two or three, because of the emphasis on open-ended methods and possibly one or two left to join other sections because of their emphasis on closed-ended methods.

Participants were informed at the beginning of the semester that permission to use their work did not have to be granted until the end of the semester. In this way, participants could hold back permission if they felt the study in anyway interfered with their learning experiences. Each participant completed a semester portfolio for the course. The portfolios contained responses to a variety of open-ended writing tasks ranging from considerations of specific pedagogical concepts and instructional strategies to extended projects. The portfolios also contained participants' evaluations of their progress and the course structure (at three different points during the semester, although only the end of semester evaluations are presented here). The participants also completed an inventory which assesses individuals' learning processes. A set of 11 applied open-ended writing assignments were selected from the portfolios as the primary protocols examined in this study and are listed next (A brief description of each task is provided in Appendix A).

P1: Convergent and Divergent Questions
P2: Role of Observational Learning
P3: Individualizing Instruction
P4: Self-Management

P5: Guiding Students in Strategies for Learning
P6: Perception/Techniques for Cognitive & Learning Styles
P7: Evaluating Open-Ended Problems
P8: Worksheet on Evaluating Mass Media
P9: Evaluating Student's Thinking Processes
P10: Plan to Avoid Discipline Problems and Create a Positive Environment
P11: Plan to Individualize Instruction

While participating in the course, individuals' work was assessed on the following five equally weighted criteria for lack of a more sophisticated assessment system:

1. Appropriateness for age and subject matter
2. Adherence to guidelines, criteria, and/or educational psychology concepts
3. In relation to their other work
4. Thoroughness and integration of ideas
5. Conceptualization or originality

Each of these five criteria were listed on assignments with feedback. Feedback was also provided within the text of their assignments as well as in other discussions. More sophisticated methods of assessment were developed for these tasks after the course was completed. The construction of these rationales is discussed in the following sections.

Preliminary Analysis of Participants' Responses to the Portfolio Tasks

As an initial investigation of the content represented in the tasks, broad pedagogical themes were formulated through a content analysis of participants' responses across all tasks. The pedagogical themes which emerged were:

1. Teacher and Student Roles
2. Educational Goals
3. Role of Content and Conceptual Structure
4. Classroom Activities and Instructional Plans
5. Evaluation and Diagnosis
6. Nature of Thinking

Participants' responses were then analyzed to develop levels of pedagogical understanding within each theme. This was accomplished through initial sorting of responses into high and low levels, with high levels representing the most sophisticated understandings and low levels the most simplistic understandings of each theme. Initial judgement of quality was based on the following continuums seen in participants' responses by two judges.

Continuums of pedagogical themes.

1. Teacher student roles and control orientation
Teacher controlled and autocratic environment vs shared control and democratic environment
Teacher as disseminator of information vs facilitator of learning
Teacher dictated structure and rules vs student involved creation of structure and governing
Emphasis on classroom management vs emphasis on students' growth

2. Educational goals
Discrete relationship vs holistic relationship between goals, activities, and perspective of learning
Goals are not purposeful or meaningful vs goals are purposeful and meaningful
Goals limit students' choices, self-direction, and interaction vs goals encourage choice, self-direction, and interaction
Goals are restricted to a limited purpose vs goals are developed to accomplish multiple purposes

3. Role of content and conceptual structure
Conceptually simplistic vs conceptual scaffolding and conceptually rich
Content simple (few connections to other ideas) vs complex (facilitating many connections to other ideas)
Content valued itself vs content valued as vehicle for growth
Surface orientation vs conceptual orientation
Organization is overly specific (rigid) or vague vs balanced in focus and structure (flexible and dynamic)

4. Evaluation and diagnosis
Basic skills vs multiple levels of skills and knowledge evaluated
Descriptive of classrooms vs causal analysis of situations (diagnosis)
Learners dichotomized vs individual needs and abilities seen as multifaceted
Rule centered vs process centered assessments and evaluations

5. Classroom activities and instructional plans
Activities are closed and teacher defined vs open to students' individual interpretations and structuring
Extremes in structuring vs well-defined, balanced structure of activities
Independent, discrete activities vs interrelated, integrated activities
Single focus vs multiple considerations in planning and structuring
Activities are rigid and set at beginning of instruction vs activities are flexible and subject to change based on a number of factors
Ill-defined vs well-defined relation between learning outcomes and purpose of activity

6. Nature of thinking
Convergent solutions expected vs divergent interpretations possible
Knowledge acquisition vs knowledge use
Learning as passive recipient process (reproductive thinking) vs learning as active construction (productive thinking)
Thinking as stagnant vs thinking as dynamic and changing

Mid-levels were subsequently chosen and then levels two and four based on the degree and sophistication of the qualities shown in each theme. Using five samples in each level, descriptions were then developed around the generalizable qualities apparent in each level as related to the themes. A description of each of the five levels within the six pedagogical themes (Levels of Understanding of Pedagogical Themes) is presented in Appendix B.

Idealized descriptions of individuals' functioning at extremes of pedagogical understanding on all categories based on themes were developed and are presented next.

Integrated descriptions of extremes in pedagogical understanding.

Level 1: Lowest level of pedagogical understanding.
The teacher's role is viewed mainly as the disseminator of knowledge and the head of an autocratic classroom. Rules are created and dictated by the teacher. The teacher has a reactive outlook on class problems. The student's role is to obey rules as given, carry out the teacher's instructions, receive information and produce or reproduce correct answers. Basic skills, the inherent value of content and facts, and classroom management are major emphases. The classroom activities and goals are structured and defined, though not well developed or conceived, by the teacher. Activities appear as extreme cases in structuring: vague and understructured or rigid, sterile and overly structured. Rationales for the goals and purposes of instruction are generally omitted, simplistic, or cannot be inferred. The instructional plans focus on independent and discrete lessons with a single focus or goal (usually of acquiring knowledge), or no apparent goal or focus. Plans are conceptually simplistic and concrete with a surface orientation to learning. Convergent answers are the outcome of instruction and evaluations are based on a rigid procedure or set of rules which define correct or appropriate answers, although the relationship between the purpose of an activity and the learning outcome is typically ill-defined. Student needs are defined in terms of simplistic categories and stereotypes and are not well integrated into concepts of classroom interaction and learning.

Level 5: Highest level of pedagogical understanding.
The teacher's role is viewed mainly as the facilitator of knowledge and as the head of a democratic classroom structure. The teacher accomplishes goals and solves problems through proactive involvement. Many goals are co-created by the teacher and the student. The student's role is to participate in the group formulation of classroom rules and consequences, participate in their own growth, and interact both cooperatively and independently. Thinking strategies, the inherent value of content as a vehicle for growth, and self-actualization are major emphases. The classroom activities and goals are initially structured and conceptually defined by the teacher to allow for subsequent student-imposed structuring, encourage cognitive processes and development, and acknowledge individual needs. Activities are structurally well-developed, dynamic, and allow for points of convergence & divergence and connection to other subject areas, concepts, and problem solving skills. Rationales for the goals and purposes of instruction are well-developed, being conceived, supported and analyzed in terms of general goals of education, the objectives of the unit, and the characteristics of the students. The instructional plans focus on lessons with multiple goals and take into account the many complex facets of the students, the classroom, and learning with a constructivist orientation to understanding. Many instructional outcomes are taken into account and evaluations are based on multiple considerations. Student needs are described in terms of broad and specific social, emotional, moral, and cognitive concerns, construction of personal meanings and are integrated into concepts of classroom interaction and learning.

Only a small percent of the participants would fit into either of these extremes, however, the descriptions are useful in initially conceiving the boundaries for assessment and represent a dynamic and holistic view of pedagogical understandings and their interdependency. The use of the scoring rationales for Levels of Understanding of Pedagogical Themes were not further validated nor was a reliability study

conducted. These themes are useful in discussing epistemological frameworks (as will be taken up in a later section) and in exploring the content represented in a group of tasks, but are too cumbersome (inefficient to directly use in scoring tasks for each individual. Therefore, task specific scoring rationales were developed to score participants' responses (as is discussed in the next section).

Construction of Levels of Pedagogical Understanding Scoring Rationales

Since each portfolio task calls for an emphasis on one or more particular educational concepts, processes, and/or an instructional plan, each task also represents a somewhat unique emphasis on one or more pedagogical themes and combination of themes. To develop task specific scoring rationales, responses from all individuals in one class section were sorted into piles, representing five levels of quality, for each portfolio task. The process was similar to that previously described except that it was necessary to employ pertinent themes (and continuum descriptions) and make adjustments around task specific considerations. From these levels, four representative samples of each level were chosen and each level was described. The result is 11 scoring rationales (Levels of Pedagogical Understanding), one for each portfolio task. A library of exemplars was developed that includes a description of each task, scoring rationales for each level, examples of responses, and scoring guidelines. The entire library is too extensive to present in this paper. Following are examples of task specific rationales and responses at extremes. Scoring rationales for Levels of Pedagogical Understanding are presented in Appendix C.

Sample Scoring Rationale and Examples.

Task P10: Plan to Avoid Discipline Problems and Create a Positive Environment. Describe how your classroom will be set-up to create a positive learning environment and describe 3 methods or ideas you will use to prevent discipline problems

Level 1 Scoring Rationale: Problems are viewed from a reactive stance with the emphasis being on classroom management procedures and/or behavior being controlled by the teacher. Self-management is typically discussed in terms of student behavior and is seen as good/bad, right/wrong, compliant/noncompliant, or indicating a problem with not getting homework finished on time, asocial behavior, or being unorganized. Pedagogical concepts are discrete and unrelated (disjoint) or only one particular concept is raised and discussed. Little explanation or understanding of the concept of self-management is relayed.

Level 1 Example: I plan on using a disciplinary action based on a course by Lee Canter. I've never taken the course but I've heard about it and used it and it works very well. First of all, when a student misbehaves, i.e., talks out in class, runs down the hall, playing around instead of paying attention, or bothering other students, his/her name will be put on the board. For most students, this is enough to make them behave because the whole class knows what a name on the board means. If the student continues to misbehave, a check will be put next to his/her name. This will cause the student to lose 5 minutes of recess. Again, for most students this can be detrimental. If the student still persists in misbehaving, another check will be put by the students name. This means the student will go out for recess but will do extra credit, which is assigned by the teacher. If the student does poorly on the extra credit, it will affect his/her grade. Finally, if a student still does not settle down, a conference will be set up with the parents, the student, the principal, and the teacher. I would think this last action would occur

very rarely. Although this type of disciplinary action does require the teacher to do a little, it isn't a lot. The teacher just puts a name and checks on the board. He/she doesn't reprimand at the time of the misbehaving occurrence.

Level 5 Scoring Rationale: Self-management is seen in broad terms of creating avenues for learning, self-awareness, conflict resolution, and creating cooperative goals. Self-management typically implies emphasis on student needs, learning to reason out problems, and maximum student freedom, participation, and responsibility for the age group. The ideas relayed involve avenues open to evolving change and therefore may not appear detailed. Pedagogical concepts are conceptually understood, integrated, and related to classroom experiences and activities.

Level 5 Example: I would have the students answer the following questions: What makes a classroom successful? They would then answer the question in essay form. I would then have a discussion based on what was said in the papers. We would then compare and contrast my expectations with theirs. From this we will develop our classroom rules. We will then as a class come up with punishments. We as a class will then enforce the rules. If someone violates a rule then he/she will have to identify what they were doing to disrupt the class and how that may affect the others. Only severe actions would call for my expelling a student from the room (i.e., fighting, drugs). The day-to-day order and rules will be those from the class. My role of authority will only come into action when needed. I would rather have them resolve their own conflicts. I would discuss with my students what my expectations are of them in the classroom (i.e., to be patient and polite when someone else is talking). Also, I would want them to address the issue in a debate.

In the examples on creating a positive environment and avoiding discipline problems, we see that in the lower level example students are not active in the process except to know what the rules are and see that their behavior is in accord with the rules. The goals of classroom management limit student choice, self-direction, and interaction, whereas, in the higher level response, the goals encourage student choice, self-direction, and interaction.

The Level 1 response indicates only a set of rules for handling discipline problems and totally disregards any emphasis on self-management. Furthermore, no description or explanation is given for why the chosen method would work. Some of the ideas expressed are disconcerting such as why doing poorly on extra credit work should lower a student's grade, that taking disciplinary action is the prime means of preventing discipline problems, that this system will be used for all misbehavior, and that the system is primarily used because it is easy.

In contrast, the Level 5 response focuses on the students as active participants in classroom governance. The teacher acts as a facilitator who guides the students through problem-solving activities to help them formulate their own rules and understand the importance of the rules in terms of others. The teacher relegates his or her authority to allow the students opportunities for self-responsibility encouraging student choice, self-direction, and interaction.

These responses also illustrate how a task elicits different understandings of pedagogical concepts. Typically, in lower level responses, few concepts are elicited and those that are elicited are narrowly perceived and have few connections to other pedagogical conceptions. In higher level responses, individuals

tend to make connections with other concepts, concepts which are seen as a crucial and integral part of structuring the task and creating solutions. These conceptual connections are seen in the Level 5 response where the student's role of learning to take responsibility and actively participate is an integral part of avoiding discipline problems and creating a positive environment. Conceptions about the teacher's and students' role in the classroom influences the way participants' structure many of the tasks as do many of the other pedagogical themes. Samples of all levels of responses to tasks are provided in Appendix D.

Interrater reliability.

Each portfolio task was scored by two trained raters. The author served as the first rater while another individual, with an education background, served as the second rater. Rater 2 was given a description of the original class assignment, a description of each level, and four representative examples for each level. Scoring guidelines were discussed. The author scored all 11 of the portfolio tasks for all participants. The second rater scored five of the portfolio tasks for all participants except for those used as scoring examples. Initial interrater reliabilities on the five assignments were r = .77, .89, .90, .92, and .68 (N = 46, 45, 46, 46, & 45 respectively). The reliabilities are thought to be lower for the first assignment because of the rater's initial inexperience with the rating system and, for the last assignment, because of a time lapse between ratings of the first four and the last assignment (one month).

Rater 2 was asked to rerate assignments one and five after an interim period of two months and one month respectively and after further discussion about the application of the scoring rationales. Subsequent interrater reliabilities on assignments one and four were r = .91, and .89 respectively. Most disagreements resulted in differences of only one level between rater 1 and rater 2. All differences were adjudicated with one hundred percent agreement before subsequent statistical analysis.

Results

This section describes the preliminary analyses of the scoring rationales for Levels of Pedagogical Understanding. Presented are tables describing the means and standard deviations obtained for ratings on each portfolio task and the correlations of ratings on each portfolio assignment with the total ratings. Ratings on the portfolio tasks during the first half of the semester are compared with the ratings from the second half of the semester (Tables are presented in Appendix E). Additionally, a content and descriptive analysis of participants' end of the semester self/course-evaluations, and a comparison of participants' ratings on Levels of Pedagogical Understanding with scores on a measure of orientation to learning (The Inventory of Learning Processes, Schmeck, Ribich, & Ramanaiah, 1977).

A comparison of means and standard deviations in Table 1 shows that some tasks appear more difficult than others. Portfolio tasks P1, P5, and P7 had the lowest means and standard deviations. These standard deviations indicate that there was less variance in participants' responses for these tasks than in other tasks. However, when looking at the means and standard deviations across tasks for all participants,

the means and standard deviations generally increased over time. It is assumed that the actual tasks did not become easier but that participants' ability to structure the tasks and obtain higher levels of understanding increased with time. Implicit in this view is that the increasing ability to structure open-ended tasks is concomitant with cognitive restructuring and developing deeper understandings of and connections between pedagogical themes and beliefs.

(insert Table 1 about here)

The internal consistency of the portfolio tasks as a whole, as indicated by coefficient alpha was .85. This relatively high internal consistency suggests that there is some general quality which is pervasive in the portfolio assignments and that each rating makes a strong contribution to the overall ratings.

The portfolio tasks were partitioned by time period, representing those assignments in the first half of the semester and the second half of the semester. The portfolios which fell into the first half of the semester are those from P1 - P5. Those in the second half of the semester encompassed P6 - P11. Between these two sets of assignments there was approximately a four-week time period. Table 2 describes the frequency of occurrence of different ranges in means for the first and second halves of the semester. During the second semester, the proportion of participants with mean portfolio scores between 1 and 2 fell from approximately 12% to approximately 6%. At the same time, the proportion of participants at the top levels (means from 4 to 5) rose from approximately 17% to approximately 33%.

(insert Table 2 about here)

The results of a T-test show a significant difference in the means of the portfolios from the first half and second half of the semester ($t = 4.313$, $P \leq .0001$, $df = 68$). The shift in percentage of participants receiving higher ratings on pedagogical understanding with a significant difference in means (comparing first half and second half partitionings) suggests that over the semester participants may have increased their ability to structure open-ended tasks and developed deeper understandings of pedagogy. Although this is presented as only preliminary evidence.

Analysis of Self/Course-Evaluations

At the end of the semester, participants were asked to write a self/course- evaluation and were simply given the instruction to "Write an evaluation of your progress in this course." Most evaluations ranged from one to two pages in length. An example of a self/course-evaluation from one of the participants is presented next.

> When I first started out in this class I had no idea how to write a lesson plan nor did I know of many activities to use in a class. As I progressed through this class, I learned from the class discussions and the readings about how children act and need to be treated. I was able to bring in my

> experiences from other classes I had this semester as well as in the past to create new activities. Since the beginning of the semester, I feel I've grown tremendously in my thought process involving education and psychology aimed at children. One thing that has helped me to grow are the portfolios assigned.
>
> For the most part, the actual assignments were somewhat vague as to exactly what to do. This was frustrating at first, but I learned I could bring in my own ideas without having to stay within restricted limits. I truly think this class has helped me expand my thinking on educational matters.

In general, participants reported that they were uncomfortable or frustrated at first because the assignments were vague or not specific enough. The tasks presented at the beginning of the semester were more difficult for participants because they were not facile in structuring open-ended problems and applying their ideas about pedagogy. A small percentage of participants were critical of the portfolio assignments and/or the course structure in general. These participants each felt there were some barriers to their progress. In most cases, except where the participant cited external influences, the criticisms cited were the lack of concrete and specific tasks with set answers.

The responses (N = 67), typically one to two pages in length, were collapsed into similar statements and grouped into five general categories: (a) teaching as a profession, (b) cognitive development, (c) personal growth, (d) attribution of change, and (e) course in general. Table 3 presents an analysis of participants' responses which reflect participants' most salient thoughts about their progress and experiences over the semester. An overwhelming number of the responses were positive. To aid in understanding the nature of the responses a brief discussion concerning each major category is presented next.

(insert Table 3 about here)

Teaching as a Profession. Participants who said they had an increase in respect and knowledge about teaching, 19 percent of the total responding, relayed that they have learned that teaching is a challenging profession which requires many skills and different types of knowledge and/or that they have a better understanding of what it is like to be a teacher. A portion of the participants, 11 percent, stated that over the semester they had become more committed to teaching and/or realized that being a teacher is something they want and need to do. A much larger portion of the participants, 30 percent, stated that over the semester they had learned some generalizable capability (such as creativity) necessary to teaching or felt that they are now better prepared to teach. A large portion of the participants, 46 percent, specified a better understanding of important concepts or obtained valuable skills such as motivating students, classroom management, organizing classroom settings, meeting individual needs, adapting diverse methods and strategies, applying theories and psychological concepts to teaching, creating lessons, developing activities, and practical knowledge of teaching. No negative responses were given in this category.

Cognitive Development. Statements coded into this category alluded to the development of reasoning, acquiring broad concepts, or seeing the connection among knowledge in different domains. A large percent of the participants, 32 percent, stated that they had learned how to develop their ideas, to support their ideas with evidence, and had expanded their knowledge base. The same percent of the participants stated that they became better at structuring open-ended situations, even though a large majority said that the experience was initially frustrating. An even larger percent of the participants, 43 percent, made statements that the knowledge they learned had direct connections or relevance to their future teaching by stating that either the ideas they have developed would be used in their classrooms or that the knowledge learned was beneficial or pertinent to their career as a teacher. Statements concerning the knowledge gained in this course being of relevance to other courses and experiences or the use of previous or general knowledge to participating in this course and structuring open-ended assignments were cited by 16 percent of the participants. Three percent of the participants made a general statement saying they did not learn very much.

Personal Growth. Statements relating to an increase in self-esteem and confidence, 27 percent of the participants, include being more comfortable at participating, more secure about one's own ideas, feeling more adequately prepared for being in the classroom (this was taken as being more emotionally prepared), more confident in handling problems (or whatever else comes along), more competent as an educator, and feeling that one's ideas were accepted. Learning how to express one's own ideas, knowing where to start on open-ended problems, increased self-discipline, and learning from experiences were all statements made about self-direction. Such statements were made by 24 percent of the participants. A large percent of the participants, 43 percent, stated that their self-awareness increased, many adding examples of personal progress or personal discoveries.

Attribution of Change. Direct attribution of change because of the open-ended tasks was made by 41 percent of the participants who generally stated that the assignments were stimulating and made them think about different ideas or situations. Three percent said that the assignments were too vague. Similarly, 38 percent of the participants stated that their progress could be directly attributed to the course in general. The statements were either general in nature stating a benefit gained from the class or that the course was beneficial because of different aspects such as the variety of topics, the open method of teaching and learning, and learning more than book facts. A majority of the participants, 65 percent, stated that they put much time and effort into into the class and assignments and it was worth it because of personal growth or an increase in the quality of their work. Eight percent said that it was too much work or that because of the amount of effort they put in they should receive a high grade for the course. Based on participants comments about their peers and the instructor, 22 percent said it was a positive experience because they learned from others' ideas and discussions, feedback was beneficial, or through interacting they learned

how to communicate with their peers. Three percent said they could not decide what the instructor's goals were.

Course in General. Comments about the course in general included statements from 27 percent of the participants on the positive aspects of the course structure. These comments included liking the course because it was informal, the class members were active participants with a great amount of input, the presentation of ideas were unique, that it was a positive experience to be in a class with others who would be teaching a wide range of subject and age groups, and that the class was set-up as individualized work and personal discovery. Eight percent of the participants said either the course was too much work for three credits, the book was slighted, the class was directed toward a lot of writing assignments and writing ability, there was a lot of time spent on theories that weren't related to education or practical uses, and/or the course dealt with things that shouldn't be covered by a psychology course. Many participants made comparisons with other courses or experiences (39 percent) saying that this experience was more beneficial than other classes or assignments they have had. A large percent of the participants, 46 percent, stated general positive feelings about the course. Such comments included being glad to have this opportunity, the course evaluations were fair, enjoying the class, and that the class was interesting. Five percent of the participants reported negative feelings about the course stating that they didn't learn very much, they should not have been required to take this course, and/or the that course was frustrating for them.

The participants' evaluations provide some support for the assumption that the differences in means over the semester reflect cognitive growth and not decreasing difficulty of tasks. Because the concepts in each successive portfolio build upon one another, it would be highly unlikely that even the same level of integration and complexity could be maintained unless some reorganization of participants' conceptual networks and frames of reference also occurred.

The next section presents an analysis of the relationship between ratings on the Levels of Pedagogical Understanding and scores on The Inventory of Learning Processes.

Comparison of Levels of Pedagogical Understanding and Learning Orientation

The purpose of this analysis was to examine the relationships between ratings on Levels of Pedagogical Understanding and an important related construct, learning orientation. The Inventory of Learning Processes (Schmeck, Ribich, & Ramanaiah, 1977) is a 62 item, true-false, self-report inventory of conceptual and behavioral processes individuals engage in when learning new material. The inventory contains four scales briefly described next.

1. Synthesis-analysis (18 items, later relabeled deep processing). Measures a meaningful orientation as opposed to a superficial orientation to processing information. The internal consistency is reported as .82 and a test-retest reliability as .88 (Schmeck & Ribich, 1978).

2. Elaborative processing (14 items). Measures an orientation to engage in elaborative processing strategies versus verbatim processing strategies. The internal consistency is reported as .67 and test-retest reliability as .80 (Schmeck & Ribich, 1978).

3. Fact retention (7 items). Measures attention to detail in processing as opposed to attention to generalities. The internal consistency is reported as .58 and test-retest reliability as .79 (Schmeck & Ribich, 1978).

4. Study methods (23 items). Measures the use of organized and persistent study habits and methods versus other methods such as repetitive practices, cramming, and rote drill. The internal consistency is reported as .74 and test-retest reliability as .83 (Schmeck & Ribich, 1978).

Participants completed the inventory three weeks into the semester. Significant correlations were found with the mean ratings on Levels of Pedagogical Understanding (total semester, N = 68; first half, N = 64; second half, N = 67) and scores on most subscales of the Inventory of Learning Processes. This pattern of correlation coefficients supports the expectation that individuals who already had thoughtful and reflective approaches to learning would perform at higher levels on the portfolio tasks. As shown in Table 6, no significant correlations were found with ratings on Levels of Pedagogical Understanding and the scores on the fact retention subscale, a scale measuring efforts to acquire and remember isolated information. Significant positive correlations ($r = .42$, $p \leq .001$ with total ratings) were obtained with study methods, a scale stressing organizational versus rote processes in learning. Perhaps the most meaningful correlations are those between Levels of Pedagogical Understanding and the analysis/synthesis subscale ($r = .42$, $p \leq .001$ with total ratings). Schmeck later renamed this subscale deep processing to more fully communicate its focus on the extent to which students critically evaluate, conceptualize, organize, and compare and contrast the information they study. These are the types of processes which should contribute to high levels of pedagogical understanding in the portfolio tasks.

(insert Table 4 about here)

Responses on self/course-evaluations at the end of the semester indicate that many of the participants saw a change in their own orientations to learning (to a more conceptual and deeper orientation) and described how their thought processes had developed over the semester. How orientation to learning and cognition interact to influence different individuals' learning should be more fully explored in

future studies. Had the instrument been administered again at the end of the semester a positive change in learning orientation may have been discernable and correlations may have been higher between scores on this instrument and the second half of the semester partitionings for Levels of Pedagogical Understanding.

Exploratory Study: Construction of A Typology of Epistemological Frameworks

The following discussion illustrates how participants' responses reflect their conceptual development and their formation of epistemological frameworks. In general, an individual's epistemological framework represents predominant understandings of pedagogy, how pedagogical themes interact and are understood, and how these understandings appear when interpreted as a whole.

Typology of Epistemological Frameworks

A typology of epistemological frameworks describes four levels of epistemological development and the conceptual processes which function in each level. These levels are simplistic, disparate, fluctuating, and developed epistemological frameworks. These were developed through an in-depth analysis of individual's work and their ratings on Levels of Pedagogical Understanding. While these descriptions were developed on ratings on Levels of Pedagogical Understanding over the semester, participants ratings often indicate that they may fall into different descriptions from one half of the semster to the next. For instance ratings for some individuals' work for the first half of the semester indicates a simplistic epistemological framework whereas for the second semester ratings fall in the mid or upper levels and indicate other epistemological frameworks have been formed. Likewise, some participants remained fairly stable over the semester.

Simplistic epistemological frameworks (approximately 16 percent of the participants). These individuals have pedagogical understandings which span the lower three Levels of Pedagogical Understanding (levels 1, 2, & 3) with means of 1.4 - 2.3 on all ratings. The individual constructs the entire classroom environment around only a few ideas and the ideas are limited, based on a restricted view and a small number of classroom considerations. The conceptual network related to any given major pedagogical concept, such as the teacher's role in the learning process, is more discretely defined and interpreted, based on only a few narrow assumptions and concepts/ideas. Therefore, ideas are difficult to elaborate upon or connect to other ideas. These individuals will interpret or make meaning of the major pedagogical concepts as a set. For example, it is typically assumed or believed that the teacher's job is to control students' behavior, the students' role is to be good and work hard toward what they are told. A strong belief or conception that the classroom should be authoritarian helps define learning as the passive acquisition of content and the students' role as passive. Activities are used as an avenue to learn content, content being seen as important in and of itself instead of as a vehicle for student growth. Individual differences may translate into easy dichotomies such as fast/slow learners and instructional strategies for aiding development into less/more practice or faster/slower pacing. Assessment is seen as giving grades

and is based on whether or not the answers given by students are correct. The underlying assumption is that content is relatively set with correct answers and set ways of learning those answers. A set of pedagogical conceptions may be sustained because the ideas are in congruence with one another.

Disparate epistemological frameworks (approximately 28 percent of the participants). These individuals hold conceptions which span all or at least four Levels of Pedagogical Understanding (levels 1-5 or levels 1-4) with means of 2.5 - 3.4 on all ratings. It is probable that these individuals more fully understand some aspects of pedagogy or see some educational goals, concepts, or beliefs as important, such as meaningful learning, but not others, such as a caring community. Individuals may struggle to incorporate their ideas about thinking and learning with what they view as classroom management. The concept of the teacher/students' roles are often disjoint from social roles and may not be seen as connected (or it is not understood how they are connected) to cognitive growth. The teacher may be oriented toward a democratic environment, but has some difficulties in grasping the ideas of students being in control of their own learning (developing the cognitive capabilities behind goal setting and self-monitoring) and learning from interaction. In this case, the teacher's role remains custodial, as the person who knows best what is needed, limiting the full realization of student self-responsibilityand shared decision-making. Likewise, an individual may have different ideals/ideas about classrooms which limit other ideas.

Fluctuating epistemological frameworks (approximately 45 percent of participants). These individuals may have understandings which span middle Levels of Pedagogical Understanding (levels 2, 3, & 4, although they may occasionally have a level 1 or level 5 rating) with means of 2.6 - 4.2 on all ratings. A disparity in pedagogical concepts is not evident. Independent conceptions are not yet solidified or robust, at times they are manifested more simplistically and at other times more complexly. This does not occur because of a large disparity among conceptions and beliefs, but because their developing conceptions are fragile and in a state of flux. The complexity and interrelationships of conceptions are evident when the context of the tasks to which they are applied is varied. As an example, an individual may manifest conceptions about individual differences in quite different ways, or have understandings of the same concept falling at different levels of complexity. When the task calls for developing divergent questions and criteria to evaluate responses to these questions, conceptions about individual differences are manifested quite differently than when the task calls for designing an ambiguous stimulus, discussing how students would perceive the situation presented in different ways (such as how students may interpret the meaning of a poem, a visual depiction of a human encounter, a song, or a collection of historical accounts of the same event), and planning for activities which encourage higher-level thinking. Each of these tasks reveals how a complex concept, such as individual differences, is integrated with other ideas. Solid connections between individual differences and how students construct meanings may be lacking if criteria for assessing students' responses are not based on meaning-making as a dynamic and evolving concept. Likewise, an individual may identify and discuss student development (both cognitive and social) as an

important individual difference, but the concept of the development of meaning remains relatively vague and unrelated to gross student development.

Developed epistemological frameworks (approximately 12 percent of all participants). These individuals' responses typically span only two Levels of Pedagogical Understanding (levels 4 & 5, although they may occasionally have a level 3 rating) with means of 4.3 - 4.8 on all ratings. Individuals who consistently function at high levels of understanding manifest deeper understandings of pedagogical concepts and their interrelationships. Pedagogical understandings of student self-responsibility, individual differences and needs, student-teacher roles in the classroom, learning as active construction, activity and content (subject matter) structures, and assessment methods are integrated with one another. For instance, actitivties are often planned to specifically elicit individual constructions of important themes, areas of learning, or subject matter content. Scaffolding to enhance student learning is included as both a learning activity and as a diagnostic assessment of learning. Learning takes place by teacher-student and student-student costructuring of ideas and goals. The role of the teacher and students is intimately connected to students formulating some of their own structure for learning (problems, solutions, and means of study) as well as facilitating a positive environment for other types of growth. Many types of growth are planned into activity structures and subject themes, often resulting in interdisciplinary instruction. Ideas about pedagogy inform and aid the individual in developing dynamic learning situations that take into account a number of classroom considerations based on broad pedagogical understandings, implicitly or explicitly stated goals of education, and what is seen as purposeful in teaching and learning. More specific considerations for individual students' needs, for group learning, subject matter, etc. are connected to these understandings.

Individual profiles, in-depth descriptions, of individuals simplistic and developed epistemological frameworks in relation to learning approach were also described for this study, but due to the length can not be presented here as supporting evidence for the proposed typology. Work underway includes a description of individual profiles of the mid-levels of epistemological development. The profiles depict the individual variation in the way meaning is constructed in relation to classroom contexts and how epistemological frameworks and the interrelationships of pedagogical concepts are formed. A rich array of individuals' work (including other work not presented in this paper) is used as evidence of how they view their role in the classroom, what their educational goals emphasize, how their pedagogical understandings affect curriculum development and instructional plans, the learning which will take place in their classrooms, and how they will assess their own students' progress. The individual profiles are discussed in light of learning approaches (based on Entwhistle and Newble's descriptions of surface, strategic, and deep orientations to learning) and individuals' unique strategies for encouraging classroom learning and develop curriculum and actitivities around subject matter.

Discussion and Implications of the Study

Participants' responses to the tasks developed for this study indicate how they might plan and solve instructional and managerial problems in a classroom context utilizing pedagogical understandings. The tasks encourage individuals to make explicit their ideas about what is important for students to learn and to structure the subject matter in meaningful and appropriate ways for the age group they will be teaching. The tasks also challenge individuals to reflect and think about their own teaching strategies and how they conceptualize the many different facets of classrooms.

The development of pedagogical understanding is facilitated when individuals have deeper approaches to learning, when they move to complex approaches in the way knowledge is perceived, organized, and integrated, and when they develop cognitive frameworks for interpreting their experiences and knowledge. The results of this study support these contentions through the analyses of the participants' task constructions. They are also supported through comparisons with self/course evaluations, scores on learning processes, and a discussion about a typology for educational epistemologies.

A notable influence on pedagogical understanding is an individual's orientation to learning, their consistent propensity to seek meaningful learning. The results of this study indicate that those individuals who do not adopt a reflective stance on learning (or, analogously, a deeper orientation to learning) may have difficulty in furthering their conceptions and understandings of how their students will learn and develop. It seems necessary that if individuals are to become competent teachers they must also engage in the same processes that we would want them to encourage in their students. Pintrich (1990) discusses the need for research to provide a comprehensive, sophisticated, and dynamic view of teachers which reflects an integration of motivation and cognition. Reflective thinking is an important concern to teacher education because it seems likely that an individual would have difficulty in developing a reflective stance and therefore in developing deeper pedagogical conceptions once a practicing teacher.

Participants' self-evaluations support contentions that the tasks encourage development of reasoning and of pedagogical understandings. In addition, these responses indicate other important influences on the participants' growth. Particularly important was the finding that personal growth is affected and that a form of empowerment comes from examining and understanding one's own epistemological frameworks and ideas about pedagogy. In this study, participants' confidence about their worth and capabilities increased as their ideas became more fully developed. Participants clearly expressed important aspects of this process and the interrelatedness of knowledge, personal variables, and empowerment. Many of the participants' responses indicated that they now felt ready to take on the difficult challenges of teaching or that they felt more capable because they have learned more about teaching. These statements were coupled with other statements about learning to develop or justify ideas, feeling more adequately prepared to teach because knowledge was gained, and/or feeling more secure about their own ideas.

Richardson (1990) advocates that teachers be in control of change, and "teachers understand and be held accountable for the pedagogical and moral implications of their decisions" (p. 13). Teacher educators, involved in evaluating preservice teachers and practicing teachers should help them understand the implications of their decisions. Through developing pedagogical understandings, individuals develop an informed discourse about teaching, learning, and worthwhile change in education. They also appear to gain a voice through developing competence and feeling personally capable. This sort of informed discourse and voice can help to facilitate meaningful discussions about pedagogy within the educational community. Without this facilitation, it would be difficult to expect teachers to understand or voice the implications of their decisions.

Implications and Applications of the Scoring Rationales

The direct implications from participants' responses indicate several areas to focus on when encouraging the development of understandings. A main concern is for individuals to develop conceptions about their students' learning as a process of active construction. In general, participants who understand learning as active construction developed plans which encourage students to engage in: (a) applying their knowledge, (b) displaying conceptual understandings of key ideas, (c) relating knowledge to broad concepts, and (d) forming conceptual networks. Participants who exhibited higher-levels of understanding also incorporated the following into their plans:

1. interdisciplinary instruction
2. an environment where many tools and resources are available to students, students learn to use the tools and resources and choose what they need
3. evidence of their role as facilitators and scaffolders
4. assessment as an integral and ongoing part of instruction
5. considerations for many forms of student development including social, moral, physical, emotional, and cognitive
6. multifaceted/multilevel learning experiences related to educational goals
7. teacher-student shared control, governing, and structuring of learning, teacher has control at certain necessary points

It is proposed that these characteristic of higher-level understanding could become learning goals of teacher education courses. Whether all individuals can reach acceptable levels of competence cannot be cannot be fully addressed in this study. It seems obvious that if an individual obtains only lower-levels of understanding by the end of their teacher education program, these levels of competence would not be

acceptable. However, these considerations should be explored before radical restructuring of teacher education is promoted such as having higher order and basic skills teachers as in Hannaway's (1992) proposal. This study was conducted over only one semester, however, the results were positive even in this short amount of time. It may take more time for some individuals. It is possible that a very small number of individuals would not ever develop deeper pedagogical understandings. This appears to be the case for only a small number of the participants in this study. Given the time restrictions in this study and the fact that most participants were only in their sophomore year of study, the outlook is hopeful for high success rates using similar methods. Furthermore, there is some initial resistance to and fear of open-ended assignments, but these feelings subside as individuals become assured that they are capable of thinking through problems and situations.

Implications for Future Research

A concern of this study is that the scoring rationales and method of assessment reflect and promote a developmental continuum in teacher education and in pedagogical understanding. Since the scoring rationales are based on levels of pedagogical understanding, they already measure a continuum of development. Future research may show how they could specifically be utilized in instruction. Other aspects of promoting a developmental continuum include their overlap with actual teaching practice.

The scoring rationales for Levels of Pedagogical Understanding have potential applications to other tasks. Much needed are tasks which may include opportunities for individuals to develop their beliefs in relation to situations more heavily emphasizing other pertinent classroom issues. Additional tasks could be developed to further individuals' understandings about how cooperative learning activities could be planned, how instruction might encourage sociomoral and emotional development in students, and about the workings of social interaction in the classroom in relation to teacher and student roles.

The task descriptions need to be refined. In many cases, small changes in the descriptions will affect how the student perceives and structures the tasks. For instance, further examination is needed about requirements stated in the tasks. One requirement which may be important to include is that individuals justify their plans, or include a rationale. Some of the tasks stated these requirements while others did not. The tasks which explicitly asked for rationales force individuals to think through their reasoning. Often, when the requirements do not ask for a rationale, no explanations are given or the task is not as fully explored. Other aspects of how the wording of tasks affect responses should also be a focus of future research.

As students progress, more complex tasks would be appropriate, tasks which require more extensive development, and tasks which require the synthesis of broad concepts. Individuals should probably also be required to construct more extensive pictures of the learning experiences they will promote in the classroom especially as related to how students may conceptualize the subject/ideas at hand, how instruction will interface with students' capabilities, how teachers provide scaffolding, how to

integrate different domains of knowledge and subject matter, and how to more fully assess the range of student learning.

The rationales for Levels of Pedagogical Understanding may be utilized to evaluate the acquisition and application of concepts, especially broad conceptions of teaching and learning and how these are organized into a set of epistemological beliefs about education. If this method were used as a part of the evaluation system, preservice teachers could evaluate their own beliefs and develop their thoughts while having a criterion standard with which to compare their conceptions. Research on the assessment of competent thinking as an integral part of the teaching and learning process is discussed by Nickerson (1989). Instituting this method of evaluation may also involve developing a system where individuals can strive for the next higher level of understanding. In Vygotsky's (1978) terms, the instructor would provide scaffolding for the individual based on their level of understanding. In turn, individuals would learn how to provide this type of learning environment for their future students. Furthermore, individuals would learn the rationale by applying it to specific subject matters, not only would subject specific knowledge and general processes in individuals be assessed, but it could allow these individuals the chance to begin developing instruction and evaluation systems to use with their own students. These projected outcomes are within the realm of possibilities with further research.

Most current thought is that the teachers should be the assessors and gatherers of information about students, this in turn should encourage teachers to become problem-solvers and dynamic evaluators, encouraging reflectivity in themselves. Frederiksen & Collins (1989) see particular benefits to employing a library of exemplars as a set of "case studies", showing students the nature of expert performance and helping them to "develop a keen sense of standards and critical judgement" (p. 30). The library of exemplars collected for this study could be used in such a manner with individual preservice teachers, for group discussions, or to train instructors in teacher education programs.

Future research on assessing pedagogical understanding in conjunction with teacher development, including continuing development during practice, would be valuable. Rationales similar to the Levels of Pedagogical Understanding could be useful in discussing and assessing videotapes in teacher training or in evaluating and providing constructive feedback to preservice teachers during student teaching. An overall evaluation procedure using the portfolio assignments, or adapting other tasks to the scoring rationale, in combination with graduated teaching experiences in classrooms would be most beneficial in encouraging preservice teachers' development. During the course of a preservice teacher's undergraduate education, a portfolio including many different indicators of the individual's level of understanding should follow them and record their progress. Results from this study also indicate that utilizing other instruments in this assessment would be valuable. The instruments utilized in this study to measure cognitive complexity, adult intellectual and ethical development, and orientation to learning would provide insights into the process of teacher development if utilized in conjunction with other indicators of development and over longer periods of time.

If an evaluation system for preservice teachers included measuring their level of pedagogical understandings in educational contexts and these were implemented based on individual development, increasing levels of understanding, and evolving epistemological beliefs, it would be an empowering situation for individuals. It would also be a huge step toward preparing them for the complexities of the classroom. Without an integrated frame of reference the teacher will probably be ill-prepared to solve problems or will feel overwhelmed when faced with the many complexities of the classroom. Using this method in preservice education
within a limited context also allows individuals a safe environment to explore and develop their ideas.

There is also evidence from the participants' self-evaluations that incorporating the methods employed in this study (with refinement) into classroom instruction would not only encourage self-reflection and self-regulation, but also would have positive effects related to other areas of personal growth such as increases in self-esteem, confidence, and self-awareness. As Richardson (1990) states that "...teacher empowerment does not occur without reflection and the development to express justifications" (p. 16).

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Appendix A: Brief Descriptions of Tasks

(Note: actual descriptions often included extensive discussions of criteria, examples, and explanations to provide guidance and scaffolding)

P1: Convergent and Divergent Questions
Develop meaningful convergent and divergent questions covering one topic and state what the purpose of each question is in learning.

P2: Role of Observational Learning
Develop a homework sheet that your students can use to evaluate some aspect of the media. Students should learn from the evaluation and learn something about the subject matter. Discuss what you would do with their results.

P3: Individualizing Instruction
Develop a short set of instruction that can be used by a student to learn independently. Explain how this instruction would fit into the other classroom assignments and the learning environment.

P4: Self-Management
Develop a plan for self-management for one student. The idea is that the student is gaining control over their learning, you are there as a mentor and facilitator!

P5: Guiding Students in Strategies for Learning
Devise a set of questions/statements to guide students in using strategies which benefit their learning.

P6: Perception/Techniques for Cognitive & Learning Styles
For this assignment, pick out a stimulus which will be presented to your students which is open to interpretations. Describe the different responses you would get to this stimulus. Explain what the next step(s) in your instruction will be.

P7: Evaluating Open-Ended Problems
Devise the criteria or method for evaluating student responses to a divergent question and provide a one paragraph rationale for your criteria.

P8: Worksheet on Evaluating Mass Media
Using the exercise you completed on observational learning devise at guiding questions which encourage problem solving and critical thinking.

P9: Evaluating Student's Thinking Processes
Design a rating sheet to evaluate student thinking processes. Explain in enough detail that you are showing how the criteria relate to your purposes.

P10: Plan to Avoid Discipline Problems and Create a Positive Environment
Describe how your classroom will be set-up to create a positive learning environment and describe what methods/ideas you will use to prevent discipline problems.

P11: Plan to Individualize Instruction
Explain how you would tailor your goals and objectives to fit the needs, interests, and abilities of different students. Describe or show what is different in the materials, your expectations, and how your plans will be implemented.

I. Teacher and Student Roles	II. Educational Goals	III. Content and Conceptual Structure	IV. Activities and Instructional Plans	V. Nature of Thinking	VI. Evaluation and Diagnosis
LEVEL 1: Teacher has unquestionable authority & controls activities and behavior where the environment is autocratic; students follow teacher-set rules & learn designated material; student behavior and learning is seen as good/bad, right/wrong; teacher acts as disseminator of knowledge and manager of student behavior.	LEVEL 1: Goals are generic and set for all students; relationships between learning outcomes, educational goals, and purpose of activity are missing, ill-defined, simple, or are illogical; goals focus on reproductive thinking. The perspective of learning is simplistic & specific.	LEVEL 1: Conceptual structure is rigid and discrete with simplistic and set definitions which are unrelated to other content; lesson content is underdeveloped, overly specific or vague, and simplistic and is valued in itself, no emphasis on conceptual understanding and usually no guiding goal(s) or rationale for choices are evident.	LEVEL 1: Activities are closed, set, rigid, & teacher defined often amounting to seatwork & lectures; classroom management & sterile non-interactive environment are emphasized; activities are independent & discrete with no relationship among or between them; lesson and activity structure is superficial, rigid, and/or ill-defined and usually and not connected to a purpose.	LEVEL 1: Learning is viewed as passive acquisition of content and thinking is seen as entailing identical processes needed by all students; thinking and learning focus on obtaining convergent/set solutions with and are almost wholly reproductive in nature; students are expected to acquire knowledge such as facts or mathematical operations although it is often not apparent that they will be applied to any situation.	LEVEL 1: Basic skills are assessed usually to the exclusion of other outcomes; classroom situations are described from a restricted and concrete view and classroom situations are typically assessed by employing a dichotomous decision-making structure of student grouping and individual capabilities; evaluations focus on rules & procedures and whether the right answers are given by the student; grades are often the only purpose of evaluation.
LEVEL 2: Teacher has majority of control in the classroom where the environment is basically autocratic; students follow teacher-set rules, learn designated material, and cooperate toward set goals; teacher disseminates knowledge and identifies goals and manages students' problems, but does take some individual differences into account.	LEVEL 2: Goals are generic in focus but may include some recognition of individual variations (defined by only a few differences) relationships between learning outcomes, goals, & activities are weak, simplistic, or ill-defined; goals are usually short term/content related and focus on reproductive thinking; learning is specific.	LEVEL 2: Conceptual structure is limited in form and depth; lesson content is underdeveloped, generally covers only a few concepts in a superficial manner; concepts are not related to other content; there is some emphasis on conceptual understanding and simplistic goals or rationales may be evident.	LEVEL 2: Activities are closed & rigid with some concern for student interest and/or involvement; classroom management emphasized, environment is non-interactive; activities are typically independent with few relationships among them; lessons & activity structure is simplistic & underdeveloped, usually without a clearly explicit purpose that connects to learning goals.	LEVEL 2: Learning and thinking are mainly viewed as the passive activity of acquiring content or basic knowledge & are seen within a very limited range of individual differences; thinking and learning focus on finding convergent solutions and are reproductive or somewhat conceptual in nature; students are expected to acquire knowledge, such as basic facts, concepts, and procedures and use in limited situations;	LEVEL 2: Basic skills are mainly addressed, some attention is given to other lower level outcomes; classroom situations are typically viewed from a dichotomous decision-making structure pertaining to student grouping and individual capabilities; evaluation focuses on rules & procedures, appropriate answers, and simple conceptual understandings; the purposes of evaluation are mainly for grading or as simple checks on learning.
LEVEL 3: Teacher is primarily a liason between students and content in a partially democratic environment; students make minor decisions concerning direction of learning and help set class rules; individual differences are emphasized although teacher remains the primary source of control setting and enforcing rules, major goals, plans, & activities.	LEVEL 3: Goals are generic with some recognition of individual differences and needs; relationships among learning outcomes, goals, & activities are simplistic; goals mainly focus on reproductive thinking but some higher order thinking is apparent; perspective of learning is simple with some broader conceptual focus and longer term learning goals	LEVEL 3: Conceptual structure is developed, having a basic/simple form, and shows some flexibility with an emphasis on covering certain content and information; lesson content is simplistic but applications and lessons are typically integrated into a whole with concepts showing some divergence, abstraction and simple interrelationships;	LEVEL 3: Activities are open to some student input, involvement, & interactions; activities have an apparent purpose, usually simplistic but sometimes with ties to broad objectives or outcomes; lessons & activity structure is defined adequately but shows lack of balance & structure, simple multiple purposes are considered but not integrated.	LEVEL 3: Learning and thinking are viewed as active processes but are defined simplistically, with emphases on convergent solutions and some simple & obvious divergent solutions; emphasis of learning is primarily conceptual in nature, usually limited in breadth of focus with limited focus on knowledge interaction; students are expected to acquire and apply conceptual knowledge and skills although problem-solving is limited.	LEVEL 3: Basic skills, conceptual knowledge, and understandings are the emphasis of assessment, but attention is given to some other higher-level learning outcomes; simple causal descriptions are given about classroom situations; evaluation focuses on learning content with some attention given to cognitive processes and individual needs. The purpose of evaluation is to inform of improvements and assign grades based on many considerations.
LEVEL 4: Teacher is mainly a facilitator, providing direction and structure, in a democratic environment; students make many decisions concerning direction of learning based on their needs and interests and participate in setting class rules and in some class governance; student responsibility is emphasized and the teacher and student co-structure learning activities.	LEVEL 4: Goals emphasize the needs of students; well-defined relationship exists between learning outcomes, educational goals, and purpose of activities; broad concepts and themes guide decision making; perspective of learning focuses on both long and short term goals but may not focus on universal themes or broad educational perspectives.	LEVEL 4: Conceptual structure is well-developed, is open to many possibilities for relating the content to other knowledge but these are simply mentioned; student needs and learning goals serve as basis for overall structuring with lesson content serving as a vehicle for cognitive and/or personal growth; concepts may be complex with strong inter-relationships and an emphasis on problem-solving and relating concepts to prior knowledge;	LEVEL 4: Activities are open-ended when possible; activities focus on cognitive growth, student interaction, and/or personal choice; structure of lessons & activity is balanced & flexible; activities are well-defined, commonly interrelated, and are connected to classroom goals and often to educational goals, but not in a fully integrated manner; more than one aspect is considered in planning & evaluation	LEVEL 4: Learning and thinking are seen as dynamic processes and are productive in nature, usually with an orientation toward divergent and open-ended solutions, application of knowledge, and focuses on conceptual understandings and organization of the individual; students are expected to engage in learning as an active process of understanding relationships and problem-solving as well as acquire basic knowledge and skills although these ideas are not fully developed.	LEVEL 4: Multiple levels of skills and conceptual understandings are assessed and are often integrated with one another; classroom situations are analyzed in a causal manner & diagnostic decisions are made based on individual learning needs; The purpose of evaluation is process-oriented and concerned with teacher and student improvement; students are seen as a source of feedback in improving the learning process.
LEVEL 5: Teacher is a facilitator/mentor, providing active and ongoing scaffolding/structuring / direction in a democratic environment; students are responsible for attending to their own needs and formulating personal & group goals on multiple levels; students and teachers co-structure learning experiences and social atmosphere including some major goals.	LEVEL 5: Goals emphasize the needs of students ; a holistic/well-developed relationship exists between learning outcomes, educational goals, and the purpose of activities; broad educational ideals are used as a frame of reference and are related to a complex network of educational concerns and universal themes.	LEVEL 5: Conceptual structure is well-developed, is open to many possibilities for relating the content to other knowledge with possibilities described; broad educational concerns/goals serve as the basis for overall structuring and conceptualization while concerns related to student needs, subject matter, and cognitive growth comprise substructuring; content valued as vehicle for cognitive & personal growth; concepts are complex/ universal with rich relationships to other goals, subjects, topics, and ideas.	LEVEL 5: Activities and experiences are open-ended and co-structured by student(s) and teacher when possible; activities focus on growth in many areas of development and place high importance on group interactions; structure of lessons facilitate an interdisciplinary approach; content and process and are connected to classroom goals and broad educational concerns; activities are interrelated and stimulate and encourage thinking; multiple perspectives and levels considered in planning & evaluation.	LEVEL 5: Learning & thinking are seen as dynamic processes including universal group trends and qualities unique to each individual; students are asked to apply knowledge, display conceptual understanding, relate knowledge to broad ideas, and form conceptual networks; learning is an active process of constructing and interpreting meaning and is multifaceted and productive in nature and this type of learning is fully facilitated.	LEVEL 5: Multiple levels of physical, social, emotional, and cognitive skills, processes, and conceptual understandings are assessed independently and holistically to gain a picture of each student and of the classroom; classroom situations are analyzed in a causal manner & diagnostic decisions are made based on individual needs and the complex dynamics of the classroom; learning & evaluation is process-oriented and is shared/discussed with the student and students engage in self and group-

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Appendix C: Rationales for Levels of Pedagogical Understanding

P1 - Convergent and Divergent Questions
Level 1: The questions, when seen together, do not form a conceptual whole and may not be related except possibly by subject area. The majority of the convergent and divergent questions lack conceptual breadth and are simplistic, i.e., the divergent question may elicit only a few words or even a one word answer which may even be known and may only be open to limited interpretations.

Level 2: Most of the questions are lacking conceptual breadth and are often phrased simplistically, stating an obvious purpose or lacking a purpose. They may however include some conceptual breadth to the questions, or state a meaningful purpose. The questions typically fit together in the sense that they all cover the same topic, but are otherwise only vaguely conceptually related. Some explanation may be given for the purpose behind the questions.

Level 3: Questions are all related conceptually to the same theme or topic. Attempts are made at identifying and explaining the purpose behind the questions. Most questions are conceptually missing interim links even if related to a particular topic, however some of the questions do appear to beconceptually linked.

Level 4: There is an overall topic or theme or purpose. Convergent questions are formed on a more conceptual basis instead of memorized answers. As a whole, the assignment seems meaningful and conceptually structured. Questions lead to more understanding of the topic as a whole and purposes may also seem more broad than at the previous level but are still vaguely defined in some cases.

Level 5: There is an overall theme or purpose. Convergent questions are formed on a more conceptual basis as in the previous level and they are conceptually interrelated to divergent questions, one question (of either type) is used as a lead-in to the next question, or questions bring up different elements (subthemes) important to the theme (there are possibly other organizational/structural characteristics which may be manifested in other assignments at this level). Often, explanations are given for why one question is used in a particular point in theinstruction and what other aspects of instruction or method would be implemented upon use.

P2 - Role of Observational Learning
Level 1: Observation required of the students are minimal and do not seem to fit the assignment. Simplistic blanket assertions may be made about subsequent classroom activities (such as there will be discussion or opinions will be sought), however these aspects are not explained and are not facilitated by either the assignment itself (what will be observed or why) or by the description of what will be done with the students' results. The assignment is mostly or totally closed-ended and appears to have little purpose in the learning process. Any rationale for the assignment is either absent, nonsensical, or is under described and appears as an unsupported assertion.

Level 2: Either the assignment or discussion may include elements of pertinent observational learning (maybe even a novel approach), but usually not both. The assignment is not well developed, either being too understructured and vague or too overly structured and rigid. The assignment doesn't open-up many learning possibilities and usually appears overly simplistic. Often, the analysis suggested for classroom activities doesn't match the observation conceptually.

Level 3: The assignment seems to reflect one of the following structural or organizational characteristics: a) observations involve quite a bit of student involvement in the topic, concepts, or observational procedures, but no explanation of what will be done with the data collected or the activities are developed while the observational data gathering is not., b) both the student observation and data analysis or classroom activities show some degree of sophistication but each are either somewhat vague or somewhat overstructured., c) observations do not seem to match the data analysis/activities well but overall the assignment seems to have some depth or conceptual breadth or each is developed to some extent.The assignment seems to hold many possibilities and ideas are explained somewhat but not fully developed or elaborated upon. A general conceptual idea, focus, or theme is usually apparent although independent concepts within the assignment are not fully integrated together or related to one another.

Level 4: The assignment is conceptually related between parts, although one or the other may be more developed conceptually. The intent or purpose or focus of the assignment is clear and is explained or can be inferred. Some ideas are not elaborated upon enough to know or infer that the students will reach a full understanding of the concepts or of the quality of thinking which is relayed as an intended outcome.

Level 5: The assignment is conceptually broad and integrated. The concepts are elaborated upon and many suggestions are given on how to integrate the topic into the classroom and how assignments might be related conceptually. A meaningful learning experience and student involvement is facilitated by requiring or allowing them to structure a major portion of their own learning experience.

P3 - Individualizing Instruction

Level 1: Individualizing instruction typically entails dichotomizing students into two ability groups such as above average/below average, fast/slow or just focusing on characteristic of students. Assertions are made about what type of instruction, activities, etc. will be instituted but these are not described well and no rationale explaining the choices made is given. The recommendations focus on obvious, stereotypical, and/or inappropriate conceptions of learning. Often the recommendations focus on more or less of something (i.e. practice, pace, facts, essays, quizzes, etc.)

Level 2: Individualizing instruction may entail focusing on one or a few characteristics of students.Descriptions are given about what type of instruction, activities, etc. will be instituted and some simplistic explanations for the choices made may be given. Any overall purpose or focus is usually absent. The recommendations focus on simplistic conceptions of learning. The recommendations may focus on more or less of something (i.e. practice, pace, facts, essays, quizzes, etc.) but also on ideas of student interests and needs to some extent.

Level 3: Individualizing instruction entails focusing on characteristics of a student or students that are based on ways of learning or learning styles, etc, but typically not on dichotomous ability characteristics. Detailed descriptions may be given about personalized or independent instruction, activities, projects, etc. that facilitate meaningful learning. The overall purpose or focus is usually to improve learning, facilitate student interests, or further conceptions. The rationale or explanation given for what is to be learned is typically not well developed or may appear to focus on surface aspects. Some explanation may be given for how the individualized instruction fits in to the classroom.

Level 4: Individualizing instruction entails focusing on many characteristics of a student or students, the students needs, and the dynamics of the classroom. Explanations are given about possible instruction, activities, etc. that will be changed to facilitate learning. The instruction typically facilitates student problem solving and so structuring of the task while facilitating broad classroom goals and/or subject matter objectives. The conceptions of individual differences in learning may or may not be detailed or elaborated upon, but the activities described open-up many avenues for student interest, abilities, and learning opportunities and focus on student constructions of learning experiences.

Level 5: Individualizing instruction entails focusing on instruction which facilitates a students general problem solving or reasoning capabilities which may have a global effect how they learn. The student is seen as a change agent involved in active participation in his/her development. The changes in the dynamics of the classroom may include both short and long term teaching goals. Explanations are given about the possibilities for change and the effect of the instruction. The overall purpose is usually to facilitate maximum student potential through analyzing their own constructions.

P4 - Self-Management

Level 1: Problems are viewed from a reactive stance with the emphasis being on classroom management procedures and/or behavior being controlled by the teacher. Self-management is typically discussed in terms of student behavior and is seen as good/bad, right/wrong, compliant/noncompliant, or indicating a problem with not getting homework finished on time, being asocial, unorganized, etc. Pedagogical concepts are discrete and unrelated (disjoint) or only one particular concept is raised and discussed. Little explanation or understanding of the concept of self-management is relayed

Level 2: Problems are viewed with an emphasis on classroom management procedures and/or behavior being controlled by the teacher. Assertions may be made that there is some control by the student but are not facilitated by other statements made. Self-management is typically discussed in terms of student behavior and is seen as good/bad, right/wrong, compliant/noncompliant, or indicating a problem with not getting homework finished on time, being asocial, unorganized, etc. Pedagogical concepts are simplistic. Goals are formed and action monitored by the teacher. Understanding of the concept of self-management is limited

Level 3: Problems are viewed with an emphasis on behavior being monitored by the teacher. Assertions may be made about positive change occuring but the rationale is not explained or supported. Self-management is typically discussed in terms of student needs or indicating a problem with not getting homework finished on time, being unorganized, or not understanding , etc. Pedagogical concepts are conceptually understood but often somewhat simplistically relayed. Goals are formed and activities are monitored by the teacher but goals are not rigidly defined.

Level 4: Self-management is viewed mainly in terms of creating avenues for learning. Specific goals are usually co-created by the teacher and student. Self-management is typically discussed in terms of student needs, learning new coping strategies, and/or learning how to learn. Pedagogical concepts are conceptually understood, integrated, and related to classroom experiences/activities.

Level 5: Self-management is seen in broad terms of creating avenues for learning, self-awareness, conflict resolution, and creating cooperative goals. Self-management typically implies emphasis on student needs, learning to reason out problems, and maximum student freedom, participation, and responsibility for the age group. The ideas relayed typically involve avenues open to evolving change and therefore may not appear detailed. Pedagogical concepts are conceptually understood, integrated, and related to classroom experiences/activities.

P5 - Guiding Students in Strategies for Learning
Level 1: Cues appear behavioral and not cognitive in nature and focus on maxims, rules, or hints for correct behavior. Correct behavior is interpreted in terms of social appropriateness, classroom procedure/management, or procedure to complete assignments. The cues focus on superficial or surface information to be relayed by the teacher and followed by the student.

Level 2: Cues appear behavioral and not cognitive in nature and focus on maxims, rules, or hints to aid in completion of a task or carry out an assignment. Behavior may be interpreted in terms of social appropriateness, classroom procedure/management, or procedure to complete assignments and/or may focus on superficial or surface information about what is being learned or what the student should or could do.

Level 3: Cues appear cognitive or affective in nature and focus on hints or aids to learning but are often concrete or surface oriented. Cues may relate to strategies a students could use but are not explained and it is difficult to infer a connection to meaningful learning. Typically, there is no stated or implicit purpose, rationale, or conceptual framework developed especially as related to how students may be conceptualizing subject matter.

Level 4: Cues are cognitive and/or affective in nature and focus on student learning and understanding on a conceptual level. Typically, the cues are integrated on more than one level. Cues may relate to strategies a students could use although they may not be elaborated upon there is a connection to meaningful learning. Typically, there is a stated or implicit purpose, rationale, or conceptual framework for the cues and these are integrated into classroom activities.

Level 5: Cues are cognitive and/or affective in nature and focus on student problem solving and individual construction of meaning. Cues are integrated dynamically into the classroom environment enabling students to use them as tools, guide their own learning, and facilitate maximum meaningful learning. Typically, there are several stated or implicit purposes, a rationale is explained, and a conceptual framework for integrating the cues into classroom activities is developed. Multilevel planning and considerations are designed.

P6 - Perception/Techniques for Cognitive & Learning Styles
Level 1: The stimulus chosen doesn't appear open to individual interpretations or students perceptions. Hypothetical responses are sometimes absent or are limited in meaning. If a purpose or focus is stated, it is superficial or is often related to rote learning. Typically at this level it appears the concept of "stimuli open to interpretations" has either been misunderstood or is simplistically interpreted and the rest of the assignment cannot be developed.

Level 2: The stimulus chosen may be open to individual interpretations or students perceptions, but the assignment may limit the range of interpretations. Hypothetical responses are sometimes absent or are limited in meaning. A purpose or focus is typically stated, but it is not elaborated upon and it is difficult to infer if meaningful learning will take place. Blanket assertions are often made about learning which are unsupported.

Level 4: The stimulus chosen is open to individual interpretations or students' perceptions. Hypothetical responses relate the use of the stimuli to meaningful learning. A purpose or focus is typically stated or can be inferred and instruction incorporating student responses is described. Activities or considerations may describe possibilities for further instruction, how students are thinking, and/or indicate a change in students conceptions.

Level 5: The stimulus chosen is open to individual interpretations or students' perceptions. Hypothetical responses relate the use of the stimuli to meaningful learning and broader classroom goals. A purpose or focus is stated or is implicit and instruction incorporating student responses on many conceptual levels is described. How students are thinking and changing students' conceptions through various techniques is a goal of the exercise. Possibilities for further instruction are explained.

P7 - Evaluating Open-Ended Problems
Level 1: The question/problem itself may or may not be divergent and open to individual interpretations. Assertions may be made that it is open however evaluation is based on correct or right answers. The evaluation criteria are simplistic and focus on superficial conceptions of quality, sometimes focusing only on quantity and are unsupported. A rationale for the evaluation procedures may be absent.

Level 2: The question/problem is open to divergent responses. Evaluation is based on a number of concerns most of which are related to knowledge, conceptions, or reasoning. The evaluation criteria are justified with superficial maxims or assertions about why they were chosen or are important but they not explained on any conceptual bases.

Level 3: The question/problem is open to divergent responses. Evaluation is based on a number of concerns most of which are related to knowledge, conceptions, or reasoning. The criteria form a conceptual whole and their purpose is stated or can be inferred but a rationale is not given in detail. Some other connections to learning or instructional methods may be described.

Level 4: The question/problem is open to divergent responses. Evaluation is based on a set of concerns with a major focus on critical thinking, developing conceptual networks, or problem solving. The purpose is stated or can be inferred, related to the subject matter or class goals, and a rationale is explained and somewhat supported. Some other connections to learning or instructional methods may be described.

Level 5: The question/problem is open to divergent responses. Evaluation is diagnostic, based on a set of concerns which focus on the student constructing understandings. The major purpose to encourage the development of thought while other purposes are related to the subject matter or class goals. The rationale explains and supports the use of the criteria. Some other connections to learning and instructional methods are further described.

P8 - Worksheet on Evaluating Mass Media
Level 1: The assignment appears irrelevant or misplaced in regards to the task as the form of the questions or concerns stated are closed-ended, are conceptually disjointed between questions, are conceptually void within questions, and are not connected to any form of problem solving or critical thinking overall. Any explanation of students' thinking, conceptualizations, or purpose is usually absent but may appear in the form of unsupported and simplistic assertions.

Level 2: The assignment appears somewhat irrelevant, misplaced, or ill-conceived in regards to the task as some questions require no problem solving or critical thinking although some may be conceptual in nature but not require any analysis on the students' part. There is usually no unifying idea or conception although sometimes the assignment will appear to be based on a particular topic, subject, or simplistic purpose. The purpose may appear vague, restricted, or ill conceived even when stated explicitly. No indication is given or can be inferred or the conceptual or instructional importance of the assignment.

Level 3: The assignment often has a unifying theme or focus which relates all questions or concerns into a whole set of instruction. Within questions or concerns some conceptual breadth and focus on problem solving is apparent. Overall, it is not apparent that the instruction would foster critical thinking and problem solving by encouraging student constructions or interpretations of meaning. Some explanations are given for the purposes as related to learning, but are often underdeveloped and may appear as descriptive but not explanatory.

Level 4: The assignment has a unifying theme and purpose and is process oriented encouraging the student to engage in active problem solving and/or critical thinking. The questions or concerns are conceptually well-developed and ask for probable or possible causes and solutions constructed by the student. An explanation of the analyses and evaluation of student responses is given.

Level 5: The assignment has a unifying theme and purpose and is process oriented encouraging the student to engage in active problem solving and/or critical thinking within a rich context. The questions or concerns are probing in nature, form a conceptual network related to the context, and ask for probable or possible causes and solutions constructed by the student. The analysis and evaluation of student responses is explained and elaborated upon in relation to classroom processes and other aspects of learning and instruction are incorporated (e.g., individual needs, connections to other assignments, connections to broad educational goals, etc.)

P9 - Evaluating Student's Thinking Processes
Level 1: Criteria may be looking for factual and convergent information, and do not focus on individual needs or processes. If there is any focus on processes it is limited, i.e, mnemonics, and not necessarily connected to how the student is thinking. Any explanation given seems to reiterate the focus on convergent answers or a focus on a definite end point, a go no go situation, either the student performs the skill or doesn't.

Level 2: Criteria may appear conceptual in nature, concerned somewhat with how students are thinking, however any focus on processes is limited and the concerns are not described or explained. The concerns and any explanation given put limits on thinking as a constructive process turning the assignment as a whole into a closed-ended experience. As a whole, the assignment may show preliminary concerns for viewing thinking from different aspects.

Level 3: Criteria are conceptual in nature, concerned with how students are thinking. The concerns raised and any explanation given describes student thinking as a constructive process, however these aspects are not pursued. How the criteria would be integrated into instruction is not described in detail but some considerations may be raised.
Level 4: Criteria are conceptual in nature, concerned with how students are thinking. The criteria and explanation given describes student thinking as a constructive and problem solving process, some aspects are pursued. How the criteria would be related to or are integrated into instruction is described and some considerations may be raised and discussed.

Level 5: Criteria are conceptual in nature, concerned with how students are thinking, general thought processes, and critical thinking or problem solving and aspects of individual differences are integrated to diagnose student strengths and weaknesses. The purpose of the criteria is to formulate a picture of each students ways of learning and reacting to situations. How the criteria would be effect instruction is described and various considerations are raised and discussed.

P10 - Plan to Prevent Discipline Problems and Create a Positive Environment.
Level 1: Problems are viewed from a reactive stance with an emphasis on classroom management procedures and controlling behavior. Student behavior is seen as good/bad, right/wrong, compliant/noncompliant. Creating a positive environment entails attention to concrete/physical aspects of the classroom. Pedagogical concepts are discrete and unrelated (disjoint). No explanation or understanding of intended purpose of methods is apparent.

Level 2: Problems are viewed from a reactive stance with the emphasis being on classroom management procedures and controlling behavior. Student behavior is mainly seen as good/bad, right/wrong, compliant/noncompliant. Creating a positive environment may entail attention to concrete/ physical aspects of the classroom and aspects related to learning (social). The learning environment may be autocratic in nature although classroom management and rule setting are not. Some explanation and/or understanding of intended purpose of methods is apparent however, the pedagogical ideas are not integrated.

Level 3: Problems are viewed from a mainly proactive stance with the emphasis being on classroom management procedures which help prevent problems and less emphasis on rule based behavior. Creating a positive environment may entail attention to concrete/physical aspects of the classroom, aspects related to learning (social and/or cognitive), and classroom management. Some explanation and/or understanding of intended purpose of methods is apparent however, the pedagogical ideas may appear integrated.

Level 4: Problems are viewed from a proactive stance with the emphasis being on classroom management procedures (which may facilitate classroom interaction). If discipline is mentioned it is generally not punitive and is instead based on natural consequences. Creating a positive environment may entail attention to concrete/physical/social aspects of the classroom, aspects related to learning (physical, emotional, social, cognitive), and classroom management. Many different ideas or concerns are described. Some explanation and/or understanding of intended purpose of methods is apparent and pedagogical ideas are usually integrated or not conflicting.

Level 5: Problems are viewed from a proactive stance with the emphases being on classroom management procedures while facilitating interaction, individuality, and awareness of classroom dynamics. Rules or discipline may be mentioned but in a non-punitive manner and are typically based on student involvement. Communication and interest in learning are most often seen as the best preventative methods. Major emphases for creating a positive environment are setting up a warm, caring, and open atmosphere and concern for students needs although other aspects may beconsidered as well. Methods and pedagogical ideas are integrated into an holistic picture of the classroom.

P11 - Plan to Individualize Instruction
Level 1: Individualizing instruction typically entails dichotomizing students into two ability groups such as above average/below average, fast/slow or just focusing on one characteristic of students. Assertions are made about what type of instruction, activities, etc. will be instituted but these are not described well and no rationale explaining the choices made is given. The recommendations focus on obvious, stereotypical, and/or inappropriate conceptions of learning. Often the recommendations focus on more or less of something (i.e. practice, pace, facts, quizzes, etc.)

Level 2: Individualizing instruction may entail focusing on one or a few characteristics of students. Descriptions are given about what type of instruction, activities, etc. will be instituted and some simplistic explanations for the choices made may be given. Any overall purpose or focus is usually absent. The recommendations focus on simplistic but appropriate conceptions of learning. The recommendations may focus on more or less of something (i.e. practice, pace, facts, essays, quizzes, etc.) but also on ideas of student interests and needs to some extent.

Level 3: Individualizing instruction entails focusing on several characteristics of a student or students. Descriptions are given about instruction, activities, etc. will be changed to facilitate individual differences. The overall purpose or focus is usually to improve learning and/or motivation. The recommendations focus on many conceptions of individual differences in learning. Although these may not be detailed or elaborated upon, some detail may be given about changes in activities.

Level 4: Individualizing instruction entails focusing on many characteristics of a student orstudents, the resultant needs for change, and the dynamics and complexity of the classroom. Descriptions are given about possible instruction, activities, etc. that will be changed to facilitate learning. The overall purpose or focus is usually to facilitate classroom goals and subject matter objectives while tailoring plans to individual differences, realizing that some students may not succeed at the same tasks. The conceptions of individual differences in learning may or may not be detailed or elaborated upon, detail is given about possible changes in activities.

Level 5: Individualizing instruction focuses on many characteristics of a student or students, the resultant needs for change, and the dynamics and complexity of the classroom. The student is seen as a change agent involved in making decisions about his/her learning. The changes in the dynamics of the classroom may include both specific and global examples. Explanations and details are given about possible instruction, activities, etc. that will be changed to facilitate learning. The overall purpose or focus is usually to facilitate maximum student potential while obtaining classroom goals and subject matter objectives. The respondent indicates that some students may not succeed at the same tasks, but also that each student may have unique capabilities.

Appendix D: Examples of Rationales for Levels of Pedagogical Understanding

P1: Convergent and Divergent Questions
Develop meaningful convergent and divergent questions covering one topic and state what the purpose of each question is in learning.

Level 1: The questions, when seen together, do not form a conceptual whole and may not be related except possibly by subject area. The majority of the convergent and divergent questions lack conceptual breadth and are simplistic, i.e., the divergent question may elicit only a few words, possibly a one word answer which may even be known, or may only be open to limited interpretations.

Example:

A. Convergent
1. When was the Declaration of Independence signed?
2. Who was the first president of the United States?
3. Who won the Battle of Bunker Hill?

B. Divergent
1. Why was the Declaration of Independence signed?
2. Why was Washington the first president?
3. Why did the U.S. win the Battle of Bunker Hill?

The convergent questions are to test the students' ability to remember important facts. The divergent questions test the students' ability to think why these events are important.

In this response, there is no conceptual connection made between the different questions. The convergent questions only ask for a one-word, correct answer to test the memorization of facts. The divergent questions simply turn the convergent questions into more open-ended forms, although it is difficult to tell if the respondent would consider different interpretations. Furthermore, the divergent questions appear misguided, confusing, and are not stated in such a way that would elicit the intended outcome, "... students' ability to think about why these events are important." With no explanation of how these questions would be used in the classroom, it is difficult to know if they would have any instructional value.

Level 2: Most of the questions are lacking conceptual breadth and are often phrased simplistically, state an obvious purpose or are lacking a purpose. The questions typically fit conceptually together, only in the sense that they all cover the same topic, but are only vaguely related otherwise. Some explanation may be given for the purpose behind the questions.

Example: Topic - Early American History

Convergent Questions
1. Who was the commander in chief in the South during the Civil War?
2. Who was the author of "Letters From a Pennsylvania Farmer?"
3. _____ Laws regulated the colonies commerce during the 1700's and imposed high duties and tariffs on non-English goods.

Divergent Questions
1. What do you think would have happened if the British would have won the War for Independence? How do you think our lives would be different? Please give examples.
2. If you could be any known person during the War for Independence, who would you be and why?
3. Describe how the mercantile system affected the American colonist. How do you think this system affected our future development of a free market?

These questions are all loosely related to the same topic, early American history, but do not form a conceptual whole (although some of the questions seem conceptually related). There is a slight variation on the way convergent questions are asked (fill in the blank) and the type of processing which may be required to answer the questions. The divergent questions are a bit more thought provoking and conceptually orientated (with follow-up questions to elicit more than a one word response) than most typical level 2 responses, however there is no explanation of how these will be used in instruction or what the purpose are as related to learning and the subject content.

Level 3: Questions are all related conceptually to the same theme or topic. Attempts are made at identifying and explaining the purpose behind the questions. Most questions are conceptually missing interim links even if related to a particular topic and theme, however some of the questions do appear to be linked conceptually.

Example: Cell Reproduction
Convergent:
1. In all organisms, the sperm and egg cells contain half the number of chromosomes found in the body cell (T/F)
2. Meiosis is the process through which cells split into two diploid cells (T/F)
3. Diploid daughter cells contain the same number of chromosomes as the parent cell from which they were formed. (T/F)

These are achievement questions to determine what the student is comprehending in this area of cells, mainly cell reproduction, and to determine if an area needs to be explained better or in a different way.

Divergent:
1. Why does a reproductive cell (sperm or egg) need to have one half of the chromosomes of a body cell? Back up your reasons with facts along with your own theory.
2. Why is there segregation of alleles and what does segregation of alleles cause to occur?
3. Why do you think there are only four nucleotides?

These questions are also achievement questions, but they are not wanting the student to give memorized facts. They are designed to make the student think about the concepts in a broader light instead of allowing them to accept the facts as they are. These questions promote creative thinking and the idea that facts can be questioned.

These questions are all related to the conceptual understanding of one complex topic, cell reproduction. While the convergent questions are all true and false, which means students could guess at the answers, they are conceptually stated so that a student could think through the answer. The divergent questions focus on important concepts, processes, and cause and effects related to cell reproduction and are thought provoking. Attempts are made at identifying the general purposes for each question type but is not explained in terms of a conceptual understanding of the subject content or the instructional process.

Level 4: There is an overall topic or theme or purpose. Convergent questions are formed on a more conceptual basis instead of rote answers. As a whole, the assignment seems meaningful and conceptually structured. Questions lead to more understanding of the topic as a whole and purposes may also seem more broad than at the previous level but are still vaguely defined in some cases.

Example: Discussion questions - "The Egyptian Cinderella"

Divergent Questions:
1. How do you think this book is different from the Cinderella story that you are familiar with? purpose - predicting information
2. Do the pictures in this book help you to imagine what it is like to live in Egypt? Do they seem real? Why? (divergent answers here will be based on the last question primarily) purpose - attention to visual details, support of opinions
3. Which of the two Cinderella stories did you like best and why? purpose - support opinion by backing it up with facts

Convergent Questions:
1. How did the falcon help Rhodopsis? (he dropped her rose-red slipper in the Pharaoh's lap) purpose - detail question
2. Rhodopsis did not have mean stepsisters in this story. Who was not very nice to her that replaces the stepsisters? (the Egyptian servant girls) purpose - comparison with familiar Cinderella story, detail question
3. Why do you think that water was so important in this Cinderella story? (because Rhodopsis lived by the Nile river) purpose - inference question, comparison with familiar story.

The overall purpose of these questions is to test reading comprehension.

These questions all relate to an overall theme, comparing two similar stories, chosen as a vehicle for the purpose, evaluating reading comprehension. Each question has been identified as assessing important aspects of reading comprehension although these are only vaguely identified. The convergent questions are formulated to help clarify, detail, and make conceptual comparisons instead of testing memorization. Divergent questions focus on various aspects of reasoning and processing information. Although the questions could be appropriate in either individual or group instruction no details are given about how this process would take place or how reading comprehension could be facilitated through instruction.

Level 5: There is an overall theme or purpose. Convergent questions are formed on a more conceptual basis as in the previous level and they are conceptually interrelated to divergent questions, one question (of either type) is used as a lead-in to the next question, or questions bring up different elements (subthemes) important to the theme (there are possibly other organizational/structural characteristics which may be manifested in other assignments at this level). Often, explanations are given for why one question is used in a particular point in the instruction and what other aspects of instruction or method would be implemented upon use.

Example: Convergent and Divergent Questions
Let's say that I'm going to introduce James Joyce's short story "The Sisters" to a senior level literature class. The day before, I introduce the topic by giving some background knowledge about the format of traditional short

stories and then moved on to introduce James Joyce as a prolific representative of this genre. I would then ask them to read "The Sisters" for the next class period, keeping in mind the format of traditional short stories as they read the text.

At the beginning of the next discussion period, I would start the discussion off with basic convergent questions to test surface level comprehension.

Q: Who is the protagonist of the story? Who is the antagonist?

A: the boy; the deceased priest

These opening questions serve to get the ball rolling and test literary vocabulary. After a few more of these type, I could then move on to more complex convergent questions.

Q: What did the boy dream about? What was the priest's transgression?

A: he dreamed about the priest confessing to him after his death; he wasn't to be found when needed

These convergent questions are important for two reasons: they help to understand the surface ideas of the story and then lay the groundwork for understanding the deeper symbolic level of the story. This symbolic level can be explored by using divergent questions

Q: Why do you suppose the protagonist's name was never mentioned?

A: any thoughtful response is correct.

By comparing the surface level to the students' thoughts about the divergent questions, interesting points of view toward the story's symbolic meaning will be reached.

Q: Why does the boy feel joy instead of sorrow at the priest's death?

A: any thoughtful answer is correct

Q: What do you think the boy's dream means?

A: any thoughtful answer is correct

Of course, many more of both types of questions are needed to get a good comprehension of the story as a whole. But by asking these types of questions, they will hopefully think about the topic and maybe even begin to question for themselves when they read. It is a guided discovery using scaffolding into the intricacies of "The Sisters" that might make the students more aware of their own reality. That's why I love literature.

In this response, the overall theme is understanding and evaluating traditional short stories, using one story as an example to explore related concepts. The questions are integrated into a set of instruction where a logical process of working through meanings is implicated and is based on ideas about how students learn and construct ideas. Both convergent and divergent questions are conceptually interrelated to the theme and one question (of either type) is used as a lead-in to the next question, or questions bring up different elements important to the theme. Explanations are given for why the questions are used at particular points in the instruction and other aspects of learning are discussed such as scaffolding, symbolic meaning, and students learning to question for themselves.

P6: Perception/Techniques for Cognitive & Learning Styles

For this assignment, pick out a stimulus which will be presented to your students which is open to interpretations. Describe the different responses you would get to this stimulus. Explain what the next step(s) in your instruction will be.

Level 1: The stimulus chosen doesn't appear open to individual interpretations or students perceptions. Hypothetical responses are sometimes absent or are limited in meaning. If a purpose or focus is stated, it is superficial or is often related to rote learning. Typically at this level it appears the concept of "stimuli open to interpretations" has either been misunderstood or is simplistically interpreted and the rest of the assignment cannot be developed.

Example: The stimulus I have chosen to present to my students will hopefully encourage them to be concerned about their classroom assignments. I will be issuing vocabulary tests each week in my class. My purpose is to help my students to learn important words used in our language and culture. My purpose is not to have more assignments to make up their final grades. If a student misses more than zero on any vocabulary test, they must retake that test. They will continue to retake the exam until they miss zero. I want to help my students expand their vocabularies. I will begin these tests at the start of the school year and continue them until the half-way point of the term. Starting the second half I will begin these same tests again. The purpose of this is to make sure the students learned the vocabulary words well enough to use them in their daily lives rather than learning them only well enough to pass the test. The individual stimulus would be the retaking of the tests.

Various responses which might occur:

1. The ideal response would be for all students to work hard at improving their vocabulary skills in order to score well on the tests. Hopefully, each student would pass the test the first time in order to move on rather than having to continually retake tests. It would also be ideal for the students to remember the words in order to pass the tests the second time around. This will tell if they really knew them or whether they only studied well enough to pass the test the first time using their short term memories.
2. Another response could be that the student could work at passing each test but soon after forgetting the information causing them to not pass the second round of tests.
3. Still another response could be that the student does not pass any of the vocabulary tests and continually falls behind because he/she has to keep retaking each test. In this case, the student would probably need one-on-one help with the subject matter.

The standard of passing is that of missing zero. This project would be used at the high school level.

The stimuli for this response, the vocabulary tests or "the retaking of tests", presents a passive situation and a closed-ended stimuli. The students' strategies in memorizing vocabulary words and how well they perform in is the focus instead of focusing on hypothetical student constructions. A focus on the conceptual or implicit meanings of words and less focus on shear mastery would have enabled the respondent to formulate hypothetical interpretations that students may construct. This change in focus could have lead into further activities to develop understandings as related use in daily life instead of leading into a pass/no pass dichotomy in evaluating learning.

Level 2: The stimulus chosen may be open to individual interpretations or students' perceptions, but the assignment may limit the range of interpretations. Hypothetical responses are sometimes absent or are limited in meaning. A purpose or focus is typically stated, but it is not elaborated upon and it is difficult to infer if meaningful learning will take place. Blanket assertions are often made about learning which are unsupported.

> Example: For a creative writing assignment I would use a page that had incomplete sentences which the student would have to fill in with their own made up words. This exercise would help students learn nouns and verbs plus encourage their writing skills.
>
> Today I went to the ___ and saw a ___ doing various moves in a ___ . There were many ___ crowded around the ___ . They were all ___ and ___ . Then, a ___ appeared and ___ to everyone. This was not what I wanted, so I ___ and went to ___ .

In this response, the stimuli is open to individual interpretations, but tehy are limited by the sentence structure. Providing some structure for students in this form may result in learning nouns and verbs (probably learning the correct placement of nouns and verbs). It is unknown if the supplied structure would actually aid learning as it may be an impediment, being too complex and confusing for students who do not already know sentence structure well. Meaningful learning may be encouraged more by allowing students to make up their own sentences. No hypothetical student responses are supplied nor is there a discussion of how this activity would fit in with instruction.

Level 3: The stimulus chosen is open to individual interpretations or students perceptions. Hypothetical responses confirm that the stimuli is meaningful and open to different interpretations or perceptions. A purpose or focus is typically stated or can be inferred but may not be elaborated upon and it is difficult to infer all of the steps in the learning process. Typically activities or considerations describe possibilities for further instruction.

> Example: Stimulus: slide show illustrating the various recently proposed techniques for waste disposal. ex: sending it into space, burying it, dumping it into the ocean, etc.
> Hypothesized Responses: I would observe the students' facial expressions to see what kinds of responses the slides produced. ex: did they look shocked, repulsed, amused, or unconcerned, etc. Since this would be for an English class, I would have each pick one of the discussed methods of disposal, research it, and write a paper on it (based on their reaction to the slide-show, they can give their opinion on the method if they desire).
>
> The stimulus is open to many different interpretations and using the stimulus in instruction opens up avenues for other meaningful activities. The hypothetical responses presented represent a somewhat limited view of how students could react. The purpose of presenting this stimulus could have been broadened by presenting one or more thought provoking questions in conjunction with the slide show to observe students' initial verbal reactions in addition to their facial expressions. Otherwise, it is possible the students would have little reaction because of prior exposure but may have opinions and concerns which they have never voiced. Student responses are not fully incorporated into the instruction.

Level 4: The stimulus chosen is open to individual interpretations or students' perceptions. Hypothetical responses relate the use of the stimuli to meaningful learning. A purpose or focus is typically stated or can be inferred and instruction incorporating student responses is described. Activities or considerations may describe possibilities for further instruction, how students are thinking, and/or indicate a some change in students conceptions.

> Example: [the stimulus shown is a boy with hands in his pockets, walking along. He looks sad. Above him is an empty caption such as in a cartoon which represents what he is thinking.] Tell me what you think this young boy is thinking. Fill in the caption with your response and tell why you think he's thinking about it.
>
> Grades - 6th and up
> The students are going to answer the question and tell why they answered that way. Some of the possible responses might be:
> - his dog died
> - he got a bad grade on a test
> - he had a fight with his friends
> - he forgot his lunch money
>
> Next, I will show the students my second picture which was to have taken place before the first picture. [Picture shows same boy with a concerned look on his face. Behind him is another boy who is angrily saying something to him and who has clenched fists. There is an empty caption over the second boy's head. It looks like the second boy may be somewhat older/bigger]. I will ask the students now to fill in both captions. The responses

should change to maybe:
- a fight with his big brother
- an older boy being mean to him
- etc.

Then we will discuss as a class why the younger boy might be upset and what he is thinking and compare responses.

This stimuli are open to many interpretations by students and, as indicated by the hypothetical responses, serve as projective devices enabling the teacher to to find out more about the students in a manner in which the students would feel safe to respond. The activities lead to meaningful learning as the students share their conceptions about how they interpreted the situation. In this case, the learning integrates both affective and cognitive responses to real life situations and problem-solving. The different presentation of the two stimuli would also allow the students to see how perceptions change based on knowing more evidence.

Level 5: The stimulus chosen is open to individual interpretations or students' perceptions. Hypothetical responses relate the use of the stimuli to meaningful learning and broader classroom goals. A purpose or focus is stated or is implicit and instruction incorporating student responses on many conceptual levels is described. How students are thinking and changing students' conceptions through various techniques is a goal of the exercise. Possibilities for further instruction are explained.

Example: For this assignment I would show the children two stimuli, related to each other. The first one will be a very descriptive, short essay. I will read to them about the beautiful and cultural aspects of the city of Detroit, without ever mentioning the word Detroit. Next, I will show them the second stimuli. This will be a set of pictures showing the bad, slum areas of Detroit. After showing the photographs, I will ask the students to write a short essay on what they just saw and heard.

There could be many different responses to these stimuli:
A. The children will believe that this is only one city and write about how there is good and bad points to every city (and situation). They will probably put more emphasis on either the good or the bad aspects depending on what stimulus persuaded them more and their background attitudes already formed about big cities.
B. They will believe that the stimuli represent two different cities. They will talk about the evils of one and the good of the other.
C. They will be persuaded mainly by the good aspect stimulus and write about the positive aspects of a city, paying little or no attention to the negative aspects.
D. They will be influenced mainly by the pictures showing bad aspects and write about the negative aspects of the city, paying little or no attention to the positive aspects.

Reviewing these responses, I could use them to teach the children a lesson on how everyone has a different response to the same situation and ask them why that is. I could also plan a lesson on how such drastically different situations can exist in the same city.

Overall, this would be a good lesson for a ninth grade essay writing class. This stimuli could be used as a part of a city unit, descriptive unit, a photography unit (a picture is worth a thousand words) or a unit showing peoples' differing attitudes.

In this response, the stimuli are not only open to interpretations, but as in the Level 4 response are set up to invoke thinking. The respondent discusses how the responses could be used in many different ways to expand students' conceptions about how people learn and are different, about a variety of subject matter concepts, and about general strategies in learning related to different modes of expression. The instruction also open to accomplishing broader educational goals such as learning about broader social and economic influences on people as a way of viewing and interpreting situations.

Appendix E: Tables

Table 1: Means and Standard Deviations for All Participants' Ratings on Levels of Pedagogical Understanding.

Portfolio Assignment	Mean	SD
P1 Convergent/Divergent Questions	2.79	1.13
P2 Role of Observational Learning	2.88	1.25
P3 Individualizing Instruction	3.34	1.24
P4 Self-Management	2.89	1.31
P5 Strategies for Learning	2.67	1.24
P6 Perception Techniques	3.56	1.31
P7 Evaluating Open-Ended Problems	2.97	1.07
P8 Evaluating Mass Media	3.38	1.24
P9 Evaluating Thinking Processes	3.34	1.34
P10 Creating a Positive Environment	3.42	1.37
P11 Plan for Individual Instruction	3.16	1.31

Table 2: Means, Standard Deviations, and Frequency Distributions for Ratings on Levels of Pedagogical Understanding for the First Half and Second Half of Semester Partitionings.

	First Half X = 2.90 SD = .81		Second Half X = 3.36 SD = .90	
Means	n	Percent	n	Percent
$1 \leq X < 2$	8	12.12	4	5.71
$2 \leq X < 3$	26	39.39	14	20.00
$3 \leq X < 4$	21	31.82	29	41.43
$4 \leq X < 5$	11	16.67	23	32.86

Table 3: Participants' Responses on Self/Course-Evaluations in Percent Responding and Average Number of Responses per Respondent

	Positive		Negative	
	Percent	Average	Percent	Average
Teaching as a profession	62	2.9	0	0.0
Respect/knowledge	19	2.0	0	0.0
Commitment to teaching	11	1.3	0	0.0
Teaching capabilities	30	1.1	0	0.0
Conceptual understanding	46	1.9	0	0.0
Cognitive Development	89	1.9	3	1.0
Development of reasoning	32	1.8	0	0.0
Structuring situations	32	1.0	0	0.0
Relevance to future teaching	43	1.6	0	0.0
General relevance	16	1.0	3	1.0
Personal Growth	59	1.8	0	0.0
Self-esteem and confidence	27	1.2	0	0.0
Self-direction	24	1.1	0	0.0
Self-awareness	43	1.2	0	0.0
Attribution of change	87	2.5	3	1.5
Open-Ended Assignments	41	1.4	3	1.0
Course in general	38	1.0	0	0.0
Time, effort, and difficulty	65	1.6	8	1.0
Peers/mentors	22	1.4	3	2.0
Course in General	70	2.0	4	2.4
Course structure	27	1.3	8	1.7
Compare to other experiences	39	1.5	0	0.0
Feelings about the course	46	1.2	5	1.5

Table 4: Correlations of Scores on the Inventory of Learning Processes with Ratings for Levels of Pedagogical Understanding.

	Inventory of Learning Processes			
	Fact Retention	Study Methods	Analysis/ Synthesis	Elaboration
Portfolios				
Total (n = 68)	.13	.50***	.42***	.27*
First Half (n = 64)	.19	.49***	.42***	.32**
Second Half (n = 67)	.05	.41***	.36**	.15

* $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$